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The Farmer's Digest

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The Farmer's Digest

Volume 14 October, 1950 Number 6

Creating Superior Cow Families

Condensed from The Jersey Bulletin

Prof. George W. Trimberger

A MODERN successful technique of breeding superior dairy cattle is to study inheritance by groups or cow families. This method or approach in breeding has yielded such favorable results that many good breeders follow it to locate genetic makeup that approaches purity. Because of the complexity of inheritance, no strain of dairy cattle ever becomes entirely pure, but some do approach it and thus variation is reduced.

The breeders that use cow family analysis or studies find the good lines within a breed and reduce to a minimum or usually entirely eliminate the marked failures and great disappointments which have been so prevalent in dairy cattle breeding in the past.

Progressive breeders consider groups of animals—all the daughters of bulls, not a few selected best ones, and all the females in a family group— rather than individual cows. These breeders recognize the fact that individual males or females transmit more like their families than like themselves.

Great transmitting bulls build cow families, and outstanding cow families that are good transmitters help make a bull great. When the two are brought together, generation after generation, they are so potent a combination that the breeder becomes marked. They bring fame and recognition to the man that perpetuates his breeding stock through this technique and sound procedure.

An outstanding cow family can assist a sire with greater and more uniform increases. A high transmitting female that approaches genetic purity can often contribute enough to almost carry a poor transmitting sire. The daughters of a bull from such cows will not show the marked decreases which are found in his daughters from

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female lines which are mixed or low in their genetic makeup for transmitting ability. However, very few females are strong enough in their transmitting ability to hold up a poor bull, especially when two such bulls are used in succession in a breeding program.

On the other hand, the use of a high transmitting sire is the best means available to rebuild a group of females whose production or type has been dissipated or reduced by the use of one or more inferior herd sires. It should also be recognized that the use of a series of sires with high transmitting ability is often a successful way to assemble or accumulate good inheritance to provide the proper genetic makeup for a high-producing family in a related group of individuals.

A successful breeder must have definite standards in mind by which to judge cow families. The following are usually considered most important:

1. High uniform production year after year when all records and all individuals are included. Heavy milk production combined with desirable test to get outstanding butterfat production.

2. Persistency of production. This is inherited and is, of course, necessary for high production.

3. Good type for the majority of the individuals in the group. This increases their sales value and productive usefulness. It provides the requirements for good wearing qualities.

4. Longevity. The length of a cow's life in a dairy herd has a direct effect on economic returns. Increased longevity results in high lifetime production, and many more calves for replacements. More cows are needed with a long and useful life.

5. Efficient reproduction with a high breeding efficiency and good genital health. Also desirable is the ability to recover when trouble occurs.

6. High resistance to disease. Some families are susceptible, others are resistent to mastitis, genital infections, hoof trouble and other diseases.

7. High transmitting ability or prepotency.

Cow families should not be made to appear good by culling or withholding part of the information. This can be accomplished by not testing or classifying the inferior or poorest individuals within the group.

However, by proper selection, it is often possible to take the good branches in a mixed cow family group and develop them sufficiently to found a desirable family. Several generations in which these prospective good female lines are combined with the right sires are necessary before one can have complete confidence and assurance that their genetic makeup is super-

ior and is not of the usual mixed variety.

This approach is practical because, after all, every breed and breeder needs more superior cow families and these have to originate somewhere. When the breeder deals with complete information, this skillful blending of superior inheritance can afford the opportunity to develop more great cow families.

If breeders are not alert to this and do not exercise the possibility of purifying genetic makeup to form additional cow families, many potentially desirable related groups will pass by unrecognized; or they may be destroyed through dissipation after they have already partially developed.

To properly evaluate a cow family the following are important:

1. All individuals should be included—culling out the poor ones results in a highly inflated and unreliable evaluation.

2. All records on each individual from a continuous testing program should be included. When only high records or records from selective testing are considered, the evaluation is inflated and the breeder does not have the facts. H. I. R. (Herd Improvement Registry) testing is desirable to get complete information.

3. Permanent records must be kept which accurately describe production, type classification ratings, breeding efficiency, genital health, occurrence of disease and any other pertinent facts. These are necessary to evaluate the family, generation after generation, when the individuals themselves are no longer available.

4. A series of generations should be included.

5. Consider both males and females used to make up the genetic composition of the group and the final individual of interest.

Only honest and sincere breeders of dairy cattle will make complete information available on outstanding cow families and great herd sires.

Every group has a few characteristics present which the breeder would alter or change if he had the opportunity or power to do so. The object in the breeding procedure is not to have too many of these objectionable features or characteristics. But a few minor negative points indicate it is a normal situation and that complete information is available. When everything is rosy, it is an abnormal happenstance or information is incomplete because some has been withheld.

The first requirement for a breeder to develop and then perpetuate superior cattle is that he be honest and deal with the facts. This is why evaluation of the man is so important in making sound selections. Possibly the best approach in making selections of either a male or female from the

herds of established breeders is to analyze and evaluate the man before you consider his cattle.

Research results and practical observations show that future herd sires possess about the same breed improvement potentialities as do the proven sires themselves when the prospective sires are selected on a sound basis; this means emphasis on a pedigree which combines great transmitting sires with outstanding cow families for successive generations. When the selection of young sires is not on this sound basis, many breeding failures are experienced.

It is apparent that when the desirable combination of sires and cows, as outlined, prevails generation after generation for the entire group, genetic purity is approached. This then guaranteees a desirable genetic makeup and good results.

This blending combination of sire and dam is extremely important because any individual gets half of its inheritance from the sire, half from the dam. The actual analysis of a prospective young herd sire can be made by elaborate mathematical tabulations in the office or by mental calculations while the selection is made in the barn. The principle and end result is the same if complete information is available and used.

Considering the breeding potentialities of an individual through group study is the surest means of evaluation known today. This method enables you to observe the over-all genetic composition and to determine what is transmitted through the ovaries and testicles of the individuals involved—which is entirely different than their own individuality in many cases. The old proverb, "Don't marry the only good girl in a bad family," is still genetically sound today.

When future predictions are based on families rather than individuals, many errors in judgment experienced in the past will be eliminated. Breeding by families provides greater possibilities to consistently breed cattle with a high percentage of desirable traits and a minimum of undesirable ones.

There are many outstanding cow families in the Jersey breed. Many of these are found in farmer-breeders herds. These families help make the breed and the breeders successful. Many other outstanding families are found in herds of large breeders. Usually these are more famous because they receive more publicity than those in farmer-breeders herds.

However, fundamentally, both are beneficial from a breeding standpoint. Sometimes more complete information is available on those that are less well known. As individuals increase in popularity, it becomes more and more costly,

from the sales standpoint, to include complete information about them. The importance attached to complete information of records depends on whether one is buying or selling. It is up to the buyer to get complete facts and thereby develop a sound philosophy of breeding.

The American Jersey Cattle Club and the breeders of Jersey cattle have long recognized the importance of good transmitting females to the Jersey breed. The tested dam program has focused attention on such cows.

Two great cow families of the Jersey breed revolve around the two cows, "Jester's Royal Maid" and "Xenias Sparkling Ivy." They are outstanding examples of superior breeding ability.

Jesters Royal Maid was classified Excellent and at an age of 6 years she produced in 365 days on 3x, 12,111 pounds of milk, testing 6.7% and containing 816 pounds of butterfat. Her abilities as a progenitor were adequately "sampled" when she was mated to seven different sires and produced 10 offspring. Her three daughters are all Excellent in type and have excelled in production. Of her seven sons, five were classified and all were Excellent, giving her a total of eight Excellent offspring with two not classified. All five of the Excellent sons were Superior Sires with splendid averages for their daughters' production and type classification ratings.

Xenias Sparkling Ivy, another great brood cow, was classified Excellent and at 7 years 3 months she produced 16,027 M., 5.5%, 916 F. in 365 days. This gave her a Medal of Merit and the Georgia state class championship. She had 10 progeny, four daughters and six sons. Their classification average score was 89% with 4 Excellent, 5 Very Good and 1 Good Plus. Her 10 tested progeny averaged 9,231 M., 5.2%, 480 F. on a 2x, 305 M. E. basis. All of her offspring are remarkable, but outstanding is Dandy Sparkling Zinnia, Excellent, Medal of Merit, Ton of Gold (2,815 lbs. fat), 10 records total 6,882 fat with 895 at 5 years 6 months. She is the dam of an 11 progeny family with nine old enough to be classified. Among these were 6 Excellent and 3 Very Good progeny. Her Tested Dam rating is given with five daughters averaging 587 F. (2x, 305 M. E.).

If more breeders undertake to combine great transmitting sires with superior cow families, future progress through breeding will be much more rapid and widespread than it has been in the past.

Great potentialities exist within a breed if, under the present program, complete information is used and family groups rather than isolated individuals are considered in a breeding program. It provides the same information as could be obtained through micro-

scopic study of the genes and chromosomes in the body cells to show the genetic make up of an individual. It provides the means to select and increase the gene frequencies for favorable characteristics.

The ancestors in a cow family show what was available for the genetic makeup for a particular animal. The accomplishments of that animal itself show what was actually obtained. The transmitting ability of the individual to the offspring further tests the desirability of the genetic composition and the prepotency available through the reproductive processes.

Selecting both good cow families and desirable sires are the success factors in breeding and they depend on each other. In either case, a breeder can't have everything but should get the most he can when making selections. Superior dairy cattle are being developed and outstanding herds stabilized by this method throughout the United States.

Whenever solid lines of inheritance are established, the entire breed benefits through satisfied and optimistic breeders that have confidence in the breed and the programs associated with its development. These gratifying results attract and motivate new breeders as well as hold the interest of those that are now established.

The end result for anyone using this approach is to gain recognition as a breeder of superior dairy cattle and to have greater economic return and success. This is always of interest to the majority of people engaged in agriculture.

Try A Lantern in Your Empty Silo

An empty silo, or an empty cistern, can be a dangerous place to crawl into. The oxygen in the air may be all used up.

It's a good idea to lower a lighted lantern into either place before you go down. If the lantern stays lit, it's OK. If it goes out, better hook a vacuum cleaner onto a hose and suck out the stale air.

Then try the lantern again before you crawl in.

Grass Seed Is His Business

Condensed from Nation's Business

Ben James

TUCKED away in the mountains of eastern Oregon is a fabulous valley. It is a small valley, only 22 by 30 miles. The towering mountains lock the bottom land in a circular wall done with murals painted by gigantic sweeps of snow and vast blotches of black forest.

In winter, a bitter wind sifts the snow over the flat acres. But, when spring and summer do their chores, turning it first to lush green, then to gold, it becomes the greatest producing area of grass for seed in this country and, so far as is known, the greatest in the world.

Back of that record is an amazing business success story. All the elements are there: individual achievement and reward for the man who made the story; greater income for many other men and the establishment of a new business that added greatly to the well-being of a community.

It is essentially the story of Howard Wagner—tall, straight-backed, sixtyish, firm of jaw and fine of feature despite the weather-beaten skin that covers his long head. It was Wagner who sowed the first crop of grass seed in the valley.

He did it only 15 years ago and against all kinds of odds. Wise agronomists warned him that the grass seed crop he had determined to plant would not pay off on his land. Neighbors, satisfied with their wheat, apple and cherry crops bestowed mildly amused smiles on the newcomer and his new crop. Despite this he put in 20 acres of crested wheatgrass for seed, the first of the many types of grass seed he now grows.

Result. Millions of farms throughout the nation have better feed for cattle and better grass bulwarking the land against erosion. Millions of homes, golf courses, parks and airports have greener turf, and the little community of the Grande Ronde Valley has $4,000,000 a year added to its net income. And Howard Wagner is by no means hard up. An indication that he is not hard up might be deduced from calculations based on the fact that after he paid his last year's income tax on the crop he took from his 968 acres, he had

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$130,000 left over for himself. And he has made $1,000,000.

When Wagner arrived in Grande Ronde Valley, his total equipment was an obligation to pay $10 an acre for 100 acres of land; an overdue note he owed on his past farm operations in the western part of the state for $17,000; and a conviction that grass seed could be grown in this tight little valley that had caught his eye on a few prior trips through its fat, willing acres.

The valley looked better to Wagner than it had to the first men and women who came through that way. The French and Spanish voyageurs of the Astor fur empire passed by and paused long enough to take in the breathtaking beauty of its amphitheater and exclaim "Grande Ronde" which stuck as its name. The Oregon Trail wound through its passes and across its level bottom, but the settlers bound further west did not pause. It wasn't until the 1860's that the first farm was staked out and the prosperous self-contained valley, which Wagner found in 1930, was established.

Valley farmers did not particularly invite new settlers or new crops when Wagner arrived. Orchards, apples, cherries and wheat had brought in a nice income through the years and, although wheat was then selling for a disastrously low price, new settler Wagner found no welcome. In fact he had a hard time finding a piece of land to try out a crop that would not sell at a low figure by the bushel but at a high price and by the pound.

He spent weeks searching for land to rent and was about to give up when he learned of an old Scotsman who had retired and might let his farm. The intriguing notion of having his land grow a crop that it could be possible to sell by the pound for as high as 60 cents and gross as high as $400 an acre had a definite appeal to the old gentleman. He let 100 acres of his land to Wagner.

The ingenuity and stubborn belief in what he set out to do carried him through the first three rugged years of failure and disappointment in his new valley, drove him on and made his dramatic success. It can be best explained by a look at some of the highlights of the first 45 years he'd lived before he came to the Grande Ronde Valley.

It was a chilly January in upstate New York near Colbrook when Howard Wagner was born on a farm there in 1884. He had little chance to look around the hard terrain. Before he was one year old his family struck out for the west. They pulled up at Grand Island, Nebraska, where his father, who knew how to make New York cheddar cheese, took a job with a frontier dairy, where he practiced his craft. Whether busi-

ness was bad or the elder Wagner wanted to farm, the youngster did not know.

But the family's next move made an everlasting impact on the seven-year-old. His father took a claim in far western Nebraska on the second leg in his western migration with his family. He built a sod hut on the treeless plains. Young Wagner's backyard playground was bounded only by the horizon. Between him and the limits of his world there was only grass. Grass in the form of wheat and rye, and virgin rangeland grass. Above him was the pleasant clear sky too infrequently marred by rain clouds. Here young Wagner learned to know grass and what it took to make it grow.

It took four years for the dry weather to starve out the Wagner family.

But by this time the 11-year-old boy was dreaming of some kind of a heaven where grass grew green and produced seed that would in turn grow more green grass.

True refugees from dry land and primitive farming methods, the Wagner family moved on over the mountains to western Oregon where Howard Wagner spent his adolescence and took the first farm of his own. The family made its final stop in the neighborhood of Corvallis, Oregon, where Wagner arrived without stake enough to get a piece of land. There were several years of odd jobs. Cutting firewood was the surest one to keep the brood in flour and meat and shoes. Those were the melancholy days of hard times of the late '90's.

It was during this period that young Wagner set off for himself, married and managed to rent 100 acres which he promptly put into grass. He planted wheat, the traditional crop of the area. Not for seed but for flour he grew his first crop. It was new soil and the first few years it raced along full of youthful vigor. But in those days there was no crop rotation, no cover crops plowed under and no fertilizer or lime, no diversification practices. The land naturally got tired of being mined and it just gave up. Fields shrank from 40 or 50 bushels an acre to 14 or 15. Wagner came slowly to the conclusion that there was no future in wheat for him.

He chose to plant for seed Austrian peas, one of the many varieties of field peas. Although they are not used for human consumption, livestock find them a palatable fare in many parts of the country. Their chief use is as a cover crop plowed under to provide green manure and enrich the soil in rotation with cotton and corn. He picked this crop because it grew rich and green, and as a practical consideration because seed for the crop could not be produced successfully in the areas where it is most in demand.

Wagner's first first in the seed business was his introduction of Austrian peas for seed in western Oregon. He came out very well on it. Not only are Washington and Oregon today the major source of seed for this crop, but Wagner personally found his place in the seed-producing business. From 1924 to 1929 he increased his holdings to 3,000 acres—got from three to five cents a pound for seed which he was harvesting at the rate of 500 pounds to the acre.

But all the time he had his eye on grass. He tried out, along with his peas, some ryegrass. It was a sideline, but it was grass and inherent in its production were all the sensitive techniques of growing grass seed. Grass seed is notoriously small and ryegass is indeed small. It runs about 275,000 seeds to the pound and the average seed yields are 600 to 700 pounds an acre. (Note: It sells for about 20 to 40 cents a pound.) Farmers who plant it find it fine for pasturage and city dwellers for lawns. Wagner was on his way into the crop he had always wanted to grow.

Then the storm struck. It hit him with emphatic fury in 1929. It left him with 3,000,000 pounds of Austrian peas and no market for them nor for his ryegrass seed either, a debt of $17,000, and a greater determination to grow grass seed.

So loaded, he took over the Scotsman's farm in Grande Ronde Valley.

Negotiations for the lease were completed too late for him to put in a crop the first year. The next season he put in his old stand-by, Austrian peas. The aphis lustily finished off the first crop for seed grown in the valley. The following season Wagner tried it again. All went well until the night before he was going into the field to harvest. Then a freak wind tore down the valley and blew his seed crop over the mountain. Wagner gave up on Austrian peas.

In 1934, with his back against the wall, he undertook to fulfill his life's ambition—to grow grass seed. He had only his experience with ryegrass seed in western Oregon to start on. No grass seed had ever been grown in the Grande Rende Valley.

Wagner sought advice from local agricultural specialists and from college professors. One local authority vetoed the grass and recommended sheep. With professorial cautiousness the learned men told him definitely that, since no grass seed had been grown in the region before, it would be foolhardy to try it without some experimental data on which to work.

Howard Wagner listened attentively, then promptly put in 20 acres of grass seed. He planted crested wheatgrass. It was not so much his nerve in going ahead against the scholars' counsel—ev-

eryone knew Wagner had nerve—but it was the astounding and revolutionary method of putting in the crop that amazed the experts. He was the first man in the United States to attempt the planting of a seed crop as he did.

He solved a basic problem of the business. Grass for seed must be pure, uncontaminated by cross pollenization from neighboring fields. But the chief hazard is the foreign grass and weed seeds that sprout up alongside the pure stock. They must be eliminated. Before Wagner came grass seed crops had been planted solid, just as lawn grass grows. The grower of the seed relied for the purity of his crop upon his selection of the pure seed and any protection against cross pollenization that he could rig up. If a solid planted field matured with a lot of strangers in it, the seed grower had only one alternative—to harvest the crop he had planned to sell for 50 cents a pound as hay at a few dollars a ton.

To beat this situation, Wagner planted his grass in four rows, 28 inches apart and 100 yards in length. Doing it this way he could see what was going on.

With the one of his four sons who farms with him he established a watch over the growing crop. Foreign grasses showed between the rows. Wagner and his son personally pushing hand cultivators, cut out all trespassers. But cultivators could go only within three inches on each side of the row. The rest was a hand job of weeding. On his hands and knees, Howard Wagner ripped out the weeds and grasses that nestled close to the pure stock. It brought taunts from his neighbors accustomed to putting in their wheat crops, waiting for them to come up and then cutting them. One stopped by while Wagner was grubbing out a row and told him that any man was daffy that would work like a Chinaman to get a yield of crested wheat seed.

Wagner's first crop came up. He stood by awaiting the verdict of the first and most important test he had to pass, one given by the state agents who certify the seed. Their job is twofold. They check the field while it is in growth and note the amount of foreign grasses in the pure seed. Their second work comes after the harvest when they test the seed for purity of stock and germination. But their primary rating is based on their field inspection; and no editor of a social register keeps a more snobbish eye on the heritage of his aristocratic entries than do the certification officials. When they inspected Howard Wagner's first row crop they found no social climbers. Plus that the best at harvesting was 99 per cent germination and 100 per cent purity.

From then on Wagner was on his way. He acquired more land

and tried out many different types of grasses for both lawns and forage. Always keeping his eye on the region in which the seed was to be used, he tested his seed stock in other parts of the country under adverse conditions and then grew only the seed that met the demands of the area in which it was to grow. He continued to expand until he has produced more than 30 types of grasses. Alta fescue, blue grass, creeping fescue, highland bent and many others make up his crops that he plants on 1,000 acres.

As Wagner succeeded in the first few crops, farmers who had thought he was certainly making a living the hard way came around to putting in his profitable crop. Now scores of farmers are putting in the grass seed that makes the valley the largest producer of grass seed in the United States.

Wagner's production of seed put him naturally in the business of cleaning it. After his first crops he rented space in an apple warehouse where he put in a small cleaning machine, which, when harvest came around again he had to dig out from behind the apple crates. Today his storage and cleaning plant occupy not only the whole of the old apple warehouse but two other larger buildings, all connecting and totaling 25,000 feet of floor space.

At this plant the seed is cleaned and sacked in 100 pound bags, the certification officials put on the blue seal and the crop is off in carload lots to wholesalers and distributors throughout the nation. These people in turn package and mark it for their trade. But Wagner is through with it when the carload lot takes off.

Today he keeps trying better seeds and improving his land and keeping out of traps. One threatened last year when the nation suffered from drought. At the end of the growing season he started to put down a well for overhead irrigation just in case it should happen next year. The well project is typical of Wagner's career.

"I thought if we got water at 300 gallons a minute and didn't have to lift it over 50 feet we would be all right," he said. "I picked up some water at 150 feet, put it in a test pump but I figured we would have to lift it too far. So I told my friend who was drilling to go on down."

At 680 feet he got more water but the pressure didn't have the zip that Wagner was looking for. By this time the more objective neighbors were suggesting that he quit. But Wagner, measuring the cost of lifting the water, went on. He can show you the bits of trees and fossils that were disgorged as the drill went down through. He hit 1,087 feet — simultaneously hard rock. Water gushed out. Wagner took a look at the flow and calculated the pressure

wouldn't irrigate more than 100 feet on its own power. He had one of his perennial decisions to make, should he take half a loaf or take a try for a whole.

His associates when they looked at the bubbling flow from the six-inch pipe suggested that there was enough water with the help of a pump to irrigate his land. Wagner felt a bit contrary to it. Taking a chance on sacrificing the water he already had, he pitched in again. He hit more hard rock. Again his friends said quit. Wagner was agreeing with them to himself but kept on. Thirty-two feet later the devil was to pay. Wagner had water all over the place. It roared out at the rate of 4,000 gallons a minute. Wagner put a bulldozer on to make a ditch to the nearest stream. When he gets it harnessed he has pressure to irrigate all of his land in a radius of a mile and a half.

Out of his experiences Wagner looks to the future of the seed producing business. He takes a bullish view of it for the next ten years. "Although the seed for lawns will probably run about even for the next five years the demand for forage grass is going to climb," he told me. "The work which has been done by the Agriculture Conservation Program in helping farmers throughout the country in putting in new pastures and improving their own has created a demand for seed that will grow a crop and protect the soil against erosion."

He also pointed out another strong bullish factor. The withdrawal of around 30,000,000 acres from allotment crop-wheat, corn, cotton and others means there is that much land that should go into grass production both to make a paying crop and to save the soil.

This year Howard Wagner still is looking ahead, and put more than half of his land in grass that can be used to supply the urgent need for grass seed which the State Production and Marketing Administration people say exists.

What makes Howard Wagner tick in the face of things that block his way? I don't know but perhaps an incident that came up while Wagner and I were on our way to see the well will help. The valley was engaged in sweating out the worst blizzard in 57 years.

We tried at least ten roads, all blocked. After a circuitous ride only a mile separated us from the well. We came on a drift that was putting on the act of being treacherous. Car tracks in the snow showed where a car had turned around and retreated only a short time before. Wagner looked at the tracks, assured me, "I ordinarily don't take much chance with snow. But we are so close to the well I hate to give up." With that he stepped on the gas and we inspected the well which we had set out to do.

Today's Fast Milking Machines

Condensed from Electricity on the Farm

George W. Kable

THERE are more milking machines in use in the United States today than ever before.

Milker sales for the eight years since the beginning of the war through 1948 averaged over 147,000 units per year. There have been good reasons for using milking machines since 1941. We needed more milk and milk-products, and the price for them was good. There was a shortage of farm help and farm wages were high. Also we had learned more about how to use milking machines successfully.

When properly used, milking machines are more sanitary and faster than hand milking. They lower milking costs and are less injurious to the udders. Few people like to milk by hand; good hand milkers are hard to hire.

Any dairyman who expects to profit by using a milking machine must really learn how to use his milking machine. If he is unwilling to do so, he should not buy a milking machine.

The thousands of dairymen who have learned and are using the modern, fast method of machine milking are pleased with results.

The methods of machine milking have changed quite completely from what they were 12 or 15 years ago. Scientists have learned the process by which milk is made in the cow's body. First, the cow must be handled so she is ready to give down her milk. This means gentle treatment and the following of a regular routine every time the cows are milked. The most generally accepted stimulant is the application of towels, wrung out of 130° water, to the teats and udder. This cleans the udder and flashes a signal to the cow's brain which starts a secretion in the pituitary gland. When this secretion reaches the udder in about 45 seconds, it causes muscle cells to contract forcing the milk into the milk ducts. The machine should be placed on the cow within one minute after this hot water stimulus is given. In about three minutes all of the milk should be drawn, and without hand stripping. The machine should then be promptly removed. With heifers, less than three minutes may be required. Most old cows can be trained to fast milking. These facts on management are important if one is to get good results from machine milking.

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Practically all milking machines today use the calf's method of getting milk. They apply a gentle "tongue" squeeze to the teat, then suck. The motor-driven vacuum pump supplies the suction, and the vacuum, operating through the pulsator applies the squeeze. The vacuum under which machines operate varies from 10″ to 15″ of mercury. The vacuum may usually be adjusted. There is some argument as to what is the best vacuum to use. Dr. W. E. Peterson of the University of Minnesota says that so long as milk is flowing from the udder, the machine exerts no force on the inside of the teat. When milked out, the machine should be removed. If it is not, vacuum enters the teat and tends to produce harmful effects. Just how much vacuum you use is not so important as how you use it.

Pulsations per minute may vary upwards from 48. Follow the instructions the manufacturer furnishes with the machine he sells you.

The milking mechanism may be assembled in different types and styles of units to fit many different barn and economic conditions.

Pipe Line Machines are most widely used. The motor and vacuum pump are located in some out-of-the-way place in barn or service room and the vacuum piped to stall cocks. Rubber hose carries the vacuum to milker pails and pulsators, thence to teat cups.

Of the pipe-line machines, there are the floor pail and suspended pail styles. The suspended pail uses shorter milk tubes but requires a strap or supporting harness over the cow. Each type has its champions. Both do good milking and may be kept clean and sanitary. Differences in costs, vacuum pumps, pulsators, timers, oiling, teat cups and ease of cleaning make up the chief selling points on different makes and styles of these machines.

One company, for example, makes a pipeline machine for 10 cows or less. It is low in cost, has a ¼ hp direct connected rotary vacuum pump and a threadless pipeline, easily installed or removed. They also make a similar unit with the same milk pails and pulsator, but for larger herds and with a larger vacuum pump. A third type with different pump and controls is made for dairymen to whom first cost is not the limiting factor.

Portable Milkers are made by some manufacturers. They cost somewhat less, save pipe and can be used and moved by tenant farmers. They are similar to pipeline milkers but with the operating mechanism on a cart that can be pushed through the barn.

One company makes a completely *self-contained milker* unit. Motor, pump and pulsator are built in one compact unit on top of the milker pail. It is available

as either a single or double unit. It has a 1-2-3-4 milking rhythm, drawing milk from one teat at a time. It has no pipeline; just plugs into a 110 volt power circuit.

The Combine Milker is stepping up rapidly in interest and sales. Like pipeline machines, it may be had in either "silks" or "cottons." Milking parlors with tiled and glassed-in observation rooms came first. Now we have combine milkers of all degrees from the sleek parlor types to the plain put-it-in-the-can units that a farmer may install in simple milking stalls.

The combine milker takes the milk from the cows, and passes it through closed containers and pipes out of the barn and into the milk room. There are three variations of the combine arrangement. The milk may be drawn into a weighing receiver at the milking stalls. After weighing, it is released and drawn by vacuum into a receiver in the milk room, from which it is piped to pasteurizer, cooler, etc. A second system which is less elaborate, omits the weighing receiver at the milking stalls. The milk goes directly from the cows into a stationary receiver in the milk room and is pumped from there to vat, etc. In the simplest system, the milk is drawn directly from the cows through pipes into milk-cans in the milk room. The equipment is made up pretty largely of the different parts of a standard pipeline machine. To these are added sanitary milk pipe, fittings, filters, valves, vacuum-tight lids for milk-cans and possibly float controls for can milk levels.

Several companies are now making combine milkers.

Milking Parlor Milkers may be either the combine type or the pail unit type. A milking "parlor" is the *production room* of the dairy farm. The parlor or room is a management arrangement for the handling of the milking job. Any type of milking equipment could be used.

The ownership and use of a milking machine may be considered similar to the ownership of a business car or tractor. Some of us should walk; some would profit by owning small cars or tractors; some need and should invest in better, larger or more costly equipment. If you cannot drive a car safely and according to the rules; and if you will not take care of it, you just shouldn't have one. The same is true of a milking machine. But a car or a milking machine will get you places faster, and some places where you could not go economically by foot or by hand.

An increasing number of owners of herds of under 10 or 12 cows are buying milkers. Lower cost machines are made especially for them.

New milkers are easier to clean than early models. New deter-

gents, bactericides and ample hot water simplify the cleaning. Teat cups and inflations are being constantly improved. Some are claimed to stay put and not climb as the udder is milked out. Stainless steel milker claws are made with straight passages, easy to keep clean and sterile. Transparent plastic milk tubing is used on some machines. Interval timers are available for use in timed milking. There is a trend toward the use of rotary vacuum pumps and pumps which require much lower horsepower than formerly. In buying a machine, you should check on the oiling requirements and reliability of operation in cold weather.

Power interruptions become less as service on rural lines improves. In emergencies the milker pumps may be driven by small gas engines or belted to tractors. A number of manufacturers suggest connecting the vacuum line to the tapped intake manifold of a car truck or tractor. Start the engine first, then open the valve to the vacuum line. Vacuum builds up to about 18" of mercury.

Milkers have been blamed for causing mastitis. Some have been discarded because of udder injuries. Some good automobiles have also been wrecked by careless or thoughtless drivers. But more and more of us ride.

In a survey of different makes of milking machines on 48 Pennsylvania farms the trouble was found not to be with the milking machines, but with the way they were misused. Equipment had been sold without giving proper instruction in its use. A re-education program brought many of these milkers back into profitable use.

Practically all manufacturers recommend fast milking. Furthermore, they have excellent instructions on just how to do it and how to care for the machine and the machine-milked herd to get best results.

A 52-page technical bulletin of the USDA on "The Relationship of Machine Milking to the Incidence and Severity of Mastitis" has recently been issued. It leaves one with the impression that the only way to have cows milked properly is to bring them to Washington to be milked by the Department's expert hand milkers. If you read the bulletin, bear in mind that the studies were completed more than ten years ago. That was back when milkers were put on cows and left until their eyes started to pull in. No one thinks of leaving a milker on a cow from 14 to 20 minutes today. And those good old reliable hand milkers are scarce and expensive.

There is no good reason for injuring udders or aggravating mastitis if you use a milking machine right. And there is no good reason for you to have a milking machine

or be in the dairy business if you will not use your equipment and cows right.

There is a definite trend toward bringing the cows to the milking machine rather than taking the machine to the cows. It is gradual and involves many management practices. Milking-room or parlor milking reduces the lifting, carrying and stooping. It saves handling milk in the barn and permits improved sanitation and the milking of more cows. The glamour of the parlor has been replaced by sound economic and labor considerations.

More than 80 per cent of the cows in the United States are in herds of ten cows or less. Without going into great detail, we would like to give you figures on 50 small herds, 25 milked by hand and 25 by machine.

	25 Hand-Milked Herds	25 Machine-Milked Herds
Av. cows in herd	5.2	9.6
Av. no. milkers	1.3	1.0
Daily time milking	146 min.	76.5 min.
Av. time per milking	73 min.	38.2 min.
Av. time per cow per milking	10.4 min.	3.9 min.
Daily wash-up time	21.3 min.	15.1 min.

Study this table. It gives you some basis for balancing the value of your time against the investment required for machine milking.

Pounds from Pills

Condensed from The Farmer

William H. Kircher

TEN choice steers from one of the feedlots at Purdue University, LaFayette, Indiana, will be marketed soon. Because 10 tiny pills were chucked under the skin of their necks at the outset of the feeding period, they are heavier and have taken on gain at much less feed cost than any of 30 other steers marketed with them.

At South Dakota State College in Brookings, only one of the little pills was injected in the necks of lambs. The treated lambs gained almost a tenth of a pound more per day and consumed 22% less feed per 100 pounds of gain than untreated lambs.

Forty-six South Dakota poultrymen have reported to extension poultry specialists that treated cockerels put on gain at lower cost and were much better fleshed than untreated cockerels.

And this is almost beyond belief. Treated steers and bulls have produced milk! They didn't turn into good dairy cows, you under-

Reprinted by permission from The Farmer, St. Paul, Minnesota, June 3, 1950

stand, but one steer produced about a half a pint of milk a day for a few days. Non-breeding cows have been freshened without calving. One has gone through eight calfless lactations. Another has gone through 10.

And what is the material that has produced these amazing results? It is diethylstilbestrol, known now simply as stilbestrol. It is a female hormone occurring naturally in the body and in some young plants, and developed artificially in the mid-30's by a British scientist. It was used in England and later in this country for some disorders of humans.

The government's Pure Food and Drug Administration hasn't yet approved stilbestrol for lambs or beef cattle, but has approved it for poultry.

Dr. W. E. Petersen, University of Minnesota, world famous for his work with dairy cattle, got some of the material in 1939. It was so costly then that work with it had to be limited to basic research. Now the cost is so low that a cockerel or a lamb can be treated for less than three cents, a steer for less than 30 cents.

Although Dr. Petersen began his work with stilbestrol in dairy cattle long before the material was tried on other animals, he has not yet found a way to get uniform results from it. One cow will react one way and one another. Because results are so unpredictable, he still regards the material as something requiring much more study before it can be used in a practical way in dairy herds. Its use on cockerels and lambs has gone beyond the experimental stage, however, and the experiment at Purdue University is already yielding some information on what may be expected of it when injected into feeder steers.

Stilbestrol is most commonly used in pill form. Some manufacturers make the pills in a 12-milligram size, others in 15. They are about half the size of a wheat kernel and a sharp-pointed plunger device is used to inject them.

The steers in the stilbestrol experiment at Purdue University were divided into three lots of 10 each. One lot was untreated, one was treated with 60 milligrams or five of the 12-milligram pills, and the third was treated with 120 milligrams or 10 of the 12-milligram pills. As in the treatment of cockerels and lambs, the pills were injected under the skin of the neck near the head.

All of the steers were put on feed November 16, 1949. All had a ration of corn and cobmeal, cottonseed meal, molasses feed, clover and timothy hay, and bonemeal and salt. At the end of 140 days the steers were weighed. The average weight of those receiving the 120-milligram dose was 63 pounds more than the untreated lot, and the average weight of those

treated with 60 milligrams was 40 pounds more.

What was just as interesting was the amount of feed consumed by the treated as compared to the untreated steers. The steers which had been given the heavier treatment ate 106 pounds less roughage and 52 pounds less of concentrate than the untreated lot, despite the fact they had gained 63 pounds more. The steers which had been given the lighter treatment also consumed less feed.

In the trials with lambs at South Dakota State College, results were almost as spectacular as with the steers at Purdue University. One treated lot of lambs gained 5.6 pounds more per head in 74 days than untreated lambs, and feed consumption (concentrates and roughage combined) was 120.9 pounds less per 100 pounds of gain. Another lot of treated lambs gained 7½ pounds per head more than the comparable untreated lot in a 92-day feeding period. The treated lot's feed consumption was 246½ pounds less than the untreated lot.

Writing about the work with lambs, Prof. R. M. Jordan, who directed it at South Dakota State College, declares in the quiet way of the scientist: "If the use of stilbestrol for larger farm animals is approved by the Pure Food and Drug Administration, it appears on the basis of the findings at this station, as well as at the Purdue Station, that it may warrant rather wide use."

Popularity of the material for treating cockerels has spread rapidly where it has been tried. In South Dakota, for example, J. Ervin Boyd, extension poultry specialist, treated a few birds two years ago. In 1949 many flock owners followed the practice. Curious about their results, Mr. Boyd and his associate in extension poultry work, Boyd Bonzer, recently sent questionnaires to several of them. Forty-six flock owners reported on the treating of 9,804 birds and all reports were favorable.

Fremont Peterson at Ivanhoe, Minn., reported that he had treated 1,100 birds last year with such splendid results as measured by rapidity and cheapness of gain and quality of the finished cockerel that he is treating 2,400 this year. In 1949 the birds were so well fleshed that Mr. Peterson got a premium of four cents a pound over the going market price.

Kimball Hatcheries at Kimball, S. D., reported on treating White Leghorns. The treated birds, it was reported, gained twice as fast as the untreated ones, and were of better quality.

Although the almost immediate effects of stilbestrol treatment of cockerels is much like the effect of surgical caponizing, they wear off in a few weeks. For this reason Mr. Boyd recommends that if

cockerels are to be kept until they weigh three pounds, they be vaccinated when they weigh two pounds. If they are to be kept to large fryer or roaster weight, about four pounds, they should be treated when they weigh 2½ pounds.

If after further studies the Pure Food and Drug Administration sanctions use of stilbestrol for lambs, cattle and hogs as it has for chickens, research with the material probably will be stepped up, and out of this research may come even more interesting results. Perhaps the use of these little pills or providing stilbestrol in some other form will one day become as common a practice as the feeding of vitamins and minerals. Meanwhile such scientists as Dr. Petersen are interesting themselves in observations of some of Nature's source of stilbestrol supply.

That young, succulent grass has a high content of a material quite like stilbestrol was long guessed and then proved by two British scientists. These men found that some of the grasses and clovers contain much of the material just before they begin to flower. Juice pressed from a tender, growing oat plant was analyzed and also found to contain much of it.

Thinking of these discoveries, Dr. Petersen has tried to correlate them with his observations of the peaks and valleys of milk production in the cows which have gone through one lactation period after another without calving. He has found these interesting correlations: The cow that went through the 10 lactation periods without calving year after year reached her peak milk production in June after she had had young, growing grasses and legumes. Another cow —this one in New Zealand—was freshened year after year with stilbestrol injections. Her peak milk production always occurred in October, which weather-wise corresponds to June in the Upper Midwest of this country.

A further interesting observation was made in Australia. There a vast semi-arid area where large numbers of sheep were produced was seeded to a hardy, fast growing, rapidly spreading kind of clover. Soon after a heavy cover was established, flock owners began having trouble with their ewes. The ewes would not conceive. This trouble was traced to the tender, young clover. The trouble became so widespread that the area was abandoned as sheep country.

In the latter experience there is the suggestion that we may one day be devising pasture mixtures containing grasses and legumes that have just enough of the female hormone to give beneficial results.

In the experience with the two cows, there is another suggestion. Perhaps we will one day be hasten-

ing the season of natural stilbestrol supply by injecting the artificial kind during late winter and spring months. With just the precise dosage necessary to stimulate cows, sows, ewes, we may get for livestock some of the beneficial ingredients of young, succulent grasses and legumes. These are interesting possibilities to ponder. Just now its practical use on the farm is limited to cockerels.

Experiment Station Founder

Condensed from The Rural New-Yorker

George A. Haven

ONE hundred years ago, a spare young man with heavy glasses and a studious appearance, was teaching school. He was 19 years old but that fact he kept to himself. To the 70 boys of Flushing Institute, he was Mr. Johnson.

Samuel William Johnson had come from upstate New York where he had attended the Lowville Academy. While there he studied chemistry under David Mayhew. Professor Mayhew must have been an inspiring teacher, for it was while Johnson was a student there that he decided to devote his life to the study of chemistry.

Johnson was the son of a farmer who had "gone West" to Lewis County, New York, about 1840. He took particular interest in the study of the development of plants from seed and the effect of fertilizers on crops. It was evident to him that much could be done to improve the farming methods of the times, based as they were on signs and old sayings. In a homemade laboratory, Johnson did the first systematic work in America in agricultural chemical research, and the little building still standing on the Johnson homestead in Deer River near Carthage, in Jefferson County, N. Y., is thus the birthplace of experimental agricultural chemistry in America.

In order to follow his chosen field of study, Johnson, with his meager savings from teaching and some help from "Uncle Abner" as he affectionately called his father, entered Yale College in 1850. There he worked under two able chemists, Professors John Pitkin Norton and Benjamin Silliman, Jr. Their School of Applied Chemistry a few years later became the

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Sheffield Scientific School of Yale University.

After a few months of study, Samuel Johnson became possessed with the great desire to go to Germany to study under Liebig who had been the first to offer laboratory instruction in chemistry and who was recognized as the greatest authority on agricultural chemistry in the world. Two years of study in Europe in the early 1850's were not an easy accomplishment, but "Uncle Abner" had become convinced that Samuel's was no idle dream. He had given each of his other sons a farm on his 21st birthday, so Samuel received an equivalent amount in money and sailed for Europe in 1853.

About one month after sailing from New York he was settled in Dr. Erdmann's laboratory in Leipzig. The second year he spent in Munich studying under the great Liebig and under Professor von Kobel. It was here that Johnson became interested in the newly established agricultural experiment station in Moeckern, a small town of Saxony three miles from Leipzig. That station had been set up in 1851.

The success of the Moeckern experiment had been so pronounced that Johnson saw in it the method he wanted to take to America by which to carry on the advancement of practical scientific agriculture. Shortly after returning to this country he commented: "There have lately been established in Germany, especially in Saxony, a number of so-called experiment stations, or experimental farms with laboratories in connection, for the exclusive object of promoting scientific agriculture. It is but a few years since the first of these was founded; now there exist already four in that little kingdom. These are intended to make science practical, and practice scientific. In the field and the laboratory, then, observation and experiment are to reveal to us the new facts which shall be the material for agricultural progress."

When Mr. Johnson returned to America in 1855, it was to become assistant professor of chemistry in the Yale Scientific School. He superintended the laboratory, gave instruction, collected fees, paid the expenses and, when necessary, tended stoves, washed apparatus and swept up the floor. During the several years that followed, this hard work continued. He built up a laboratory and designed and made many pieces of apparatus to meet the needs of this new science of agricultural chemistry.

Before five years had elapsed, a wealthy New Haven resident, Joseph E. Sheffield, who had become interested in the Scientific School which later was to bear his name, provided funds so liberally that Professor Johnson's department had no equal on the Ameri-

can continent. From this laboratory came much important scientific material during the years following.

Almost as soon as he arrived in New Haven from his European sojourn, Samuel Johnson was invited to join the editorial staff of the *Connecticut Homestead*. This connection he welcomed, for it afforded an opportunity to begin the arduous process of bringing scientific agriculture to those who could most benefit by it, the farmers. During this period he also was an occasional contributor to *The Rural New-Yorker*. Soon after came an invitation to address the Connecticut Agricultural Society, of which he shortly became the chemist. His report as such, delivered to the Society on January 12, 1858, along with similar work done for the Society before he had official connection with it, may well be referred to as the beginning of the Agricultural Experiment Station movement in America.

It required untiring labor to get the Connecticut legislature to set up the State's Experiment Station. Professor Johnson visited many places throughout the State, lecturing and leading discussions with local farmers' organizations. He prepared an article entitled "Science as a Means of Agricultural Progress" which was circulated in quantity. He also spent much time at the meetings of the State legislature and urged influential farmers of the State to do the same. All of these influences had their effect. Finally in 1875, a two-year arrangement was effected with the University at Middletown, whereby aid was given to it to carry on appropriate work. This effort produced rather limited results and it ended with the expiration of the two-year appropriation. Before that time had elapsed, the legislature passed "an act establishing the Connecticut Agricultural Experiment Station" as an independent State institution for the purpose of promoting agriculture by scientific investigation and experiment. To be assured that the purposes of the act were carried out, the lawmakers identified with the movement the sincere and persistent man they had come to know as the one above all most interested. The eighth section of the act begins: "Professor Samuel W. Johnson of New Haven is hereby empowered to appoint and call the first meeting of the Board of Control." Immediately on organization, on April 11, 1877, he was chosen director of the Station and eighth member of the Board. Three weeks later the executive committee proceeded to equip the Station and commence operations. Dr. E. H. Jenkins, who later succeeded Professor Johnson as director of the Connecticut Station, and Dr. H. P. Armsby, who later became director of the Pennsylvania Station, joined him and

the three constituted the staff.

Mr. Johnson's first valuable work, which was systematically set up when the Agricultural Experiment Station was established, was the analysis of commercial fertilizers. For years Connecticut farmers had been unmercifully defrauded by unscrupulous dealers who sold "fertilizers" that were little more than dirt. Farmers were invited to bring samples of their fertilizers to the new Connecticut Station to have them analyzed. Many samples came. Mr. Johnson worked long hours to make reports on them but the farmers saw the practical benefit of his work, and came to a realization of the value of "book-learning" in relation to practical farming.

The first bulletin issued by the Connecticut Agricultural Experiment Station, dated August 18, 1877, was in Professor Johnson's own handwriting. It was made with an Edison electric pen and duplicating press, so that copies could be used for circulation to newspapers and farmers' clubs. It gives an analysis of the "Composition for Grass," quite wisely not called a fertilizer by its manufacturer. "As analyzed the sample contains but four per cent of plant food—96 per cent is water, vegetable matter and earth, not worth barreling." This was the very beginning of the movemnet which developed into laws requiring not only fertilizers but foods and drugs to be labeled as to their contents.

For five years the Station was housed in old South Sheffield Hall on the Yale Campus. In 1882, with an increased appropriation, it was moved to its present location on the outskirts of New Haven. In 1887 the Congress of the United States passed the Hatch Act, which gave Federal aid to the Connecticut Station and to the stations that meanwhile had been established in a number of other States.

The first "object and duty" of an experiment station mentioned in the Hatch Act is "to conduct original researches or verify experiments on the physiology of plants and animals," and in Connecticut the first funds received under that act were used to set up a new department for the investigation of fungus diseases in plants. One of its first accomplishments was the identification of the organism causing potato scab, (*Oospora Scabies*).

In 1889, Professor Johnson's son-in-law, Dr. Thomas B. Osborne, began the study of the nitrogenous matters contained in the oat kernel. From this developed a systematic research in the study of proteins which Dr. Osborne carried on for 40 years and which is still continued on a more extensive scale under the inclusive heading of biochemistry. In 1894 when this work was well estab-

lished, Professor Johnson brought about the organization of an horticultural department in the Connecticut Station. From this department, and similar departments in other stations, come all of the help and advice which anyone in the United States can obtain regarding the control of pests and the care of orchard and garden. In the next year Professor Johnson prepared and the legislature of Connecticut passed a general pure food law which was one of the very early efforts to protect the public from adulteration of foods.

The fact that, by 1887, every State and territory in the Union had an experiment station is the best indication that Professor Johnson had a sound idea and built upon it well. And now each state station is not only in existence, but has enlarged and developed numerous facilities. Because they are as independent from each other as the States are independent, each station thinks and acts independently of all the rest, thereby fostering an individual program and developing it in its own way. There is no federal control over them. There is an Office of Experiment Stations, established in 1888 by act of Congress, which is a clearing house between them, and is useful in coordinating some of their efforts, but it in no sense directs their policies.

The Blueberry Story

Condensed from American Fruit Grower

Stanley Johnston
Michigan Experiment Station

"It's as American as blueberry pie."

There is much to substantiate this saying, for the blueberry is one of our few important native fruits. Nearly all of the others including the apple, peach, pear, and orange were brought to America from other parts of the world.

When the first white settlers arrived in North America, the blueberry was present in abundance in many places. It was highly regarded by the Indians, and our pioneer forefathers soon appreciated its goodness and usefulness. It came to occupy an important place in their diet.

Wild blueberries were widely distributed throughout the United States and Canada. There are six

Reprinted by permission from American Fruit Grower.
Cleveland, Ohio, May 1950

types or species of importance: the lowbush type of northern and northeastern United States extending up to the Arctic Circle in Canada and east to the Atlantic; the highbush, extending from southern Michigan east to Massachusetts and south along the Atlantic Coast; the rabbiteye of the southern and southeastern States; the dryland, or low, in the Appalachian and Ozark Mountains; the mountain blueberry in the Cascade Mountains of Washington and Oregon; and the evergreen, or box, blueberry of the coastal sections of northern California, Oregon, Washington, and extending into British Columbia.

Of these species, the lowbush is most important as a source of wild blueberries. Large quantities are harvested in Maine and in parts of Canada. All of the other species have some value for their fruit, and the branches of the evergreen blueberry are sold for decorative purposes.

The supply of wild blueberries was adequate for all needs nearly 300 years. Then the clearing and use of land for other crops reduced the harvest considerably. Also, better forest fire control permitted trees and other vegetation to crowd out the lowbush blueberry which was so common in many northern and eastern areas.

Early in this century, U. S. Department of Agriculture officials realized that wild blueberries were becoming scarce. They started investigations aimed at growing blueberries under cultivation. The late Dr. F. V. Coville, who was placed in charge of this project, learned that the blueberry plant must have a very acid soil for successful growth.

This was a discovery of first importance and explained many earlier and unsuccessful attempts to grow blueberries in home gardens which usually had been well limed. Also, by locating superior wild plants and hybridizing them, Dr. Coville developed most of the varieties now being grown under cultivation. These varieties are much larger and more attractive than the wild sorts from which they came.

Another pioneer in blueberry culture was Miss Elizabeth White of Whitesbog, N. J. She made a valuable collection of superior wild varieties and moved them in to what was probably the first successful field of cultivated blueberries in America. One of her selections, Rubel, has been one of the leading varieties in the cultivated industry. Miss White's collection of varieties was made available to Dr. Coville to use in his blueberry breeding investigations.

Dr. Coville and Miss White both worked with the northern highbush blueberry, as they thought that it had the best possibilities for immediate development into a cultivated blueberry industry. Ad-

ditional work has been done with this species by a number of northern and eastern experiment Stations. Consequently, the present cultivated blueberry industry is located in New Jersey, Massachusetts, New York, northern Indiana, Michigan, Washington, and has extended as far south as North Carolina where some New Jersey growers first established plantings for the early market.

While the North Carolina plantings have been generally successful and have enjoyed the advantages of the early market, there is evidence to indicate that this area is a little too far south to grow the northern highbush blueberry to best advantage. The North Carolina Experiment Station and the USDA have a breeding experiment underway to develop varieties better adapted to this region.

The northern highbush blueberry succeeds only about as far north as a line extending from the lower part of southern Michigan to southern New Hampshire. North of that the lowbush species is found in many places. As the lowbush is too low and spreading and produces too small berries to be desirable for growing under cultivation, attempts have been made, especially by the Michigan and New Hampshire Experiment Stations, to cross the lowbush and northern highbush. It is hoped that some satisfactory intermediate types for cultivation in far northern areas will be obtained. This work is progressing slowly but shows some promise.

The rabbiteye blueberry, which is native to several southern and southeastern States, has great possibilities, but better varieties are needed. The USDA has been working to improve this species, and the Georgia Coastal Plain Experiment Station at Tifton has a splendid research program under way that should eventually do much to improve the southern highbush blueberry and pave the way for a cultivated blueberry industry in the South.

It is estimated that there are now about 6,500 acres of cultivated blueberries in the United States. About half of this acreage is in New Jersey. Michigan has about 1,700 acres and North Carolina about 1,000 acres. Smaller acreages are in Massachusetts, Indiana, Washington, and other States. The estimated acreage includes bearing and nonbearing fields.

The average production of cultivated blueberries at present is estimated at about 16.5 million pints. The gross value of this crop last year was between three and four million dollars. This is not a large industry compared to many of the older fruit crops, but it must be remembered that the cultivated blueberry industry is comparatively very new. The industry is growing steadily and at some fu-

ture time the blueberry will very likely be one of our most valuable small-fruit crops.

A large share of the cultivated blueberry crop of the nation is marketed co-operatively. Berries must be packed according to certain grade requirements. They are placed in pint boxes which are covered with attractively designed and printed cellophane. Nearly half of the crop is now going to processors, both for canning and freezing, and the large berries produce an excellent processed pack.

The most important point to be considered in blueberry growing is to find the proper soil in a location having a suitable climate. Blueberry plants are very sensitive to soil conditions. The soil must be very acid, preferably having a pH of from 4.0 to 5.1. Attempts have been made to acidify soil with sulfur, aluminum sulfate, and other materials, but this practice cannot be recommended for commercial blueberry culture.

In addition to the proper degree of soil acidity, a somewhat moist soil is best. Extremes in soil moisture are injurious to best growth.

Acid, moist soils are usually found in low places. Such sites are likely to be frosty. Pockets surrounded closely by higher land are very susceptible to frost and should be avoided. Wide, open areas have less of a frost hazard.

The blueberry is not easy to propagate by ordinary methods and requires special treatment as well as careful attention for successful results. Growers of small numbers of plants, or beginners in the business, will usually find it cheaper and more convenient to purchase their plants from nurserymen or growers offering them for sale.

There are a number of varieties to select from. A good list in order of ripening would be Weymouth, Stanley, Berkeley, Jersey, and Coville. Berkeley and Coville have just been introduced by the USDA.

The best method of growing blueberries in the home garden that the writer has observed is to obtain some old 60-gallon oil drums. Old ones can usually be found at a low cost. Cut them in two to make two tubs. Burn them out to remove all traces of oil, or other material that might have been in the barrel. Drill about six one-inch drainage holes in the bottom of each tub. Bury in the ground until only an inch or two of the rim extends above the surface of the soil.

If soil can be found nearby having a pH of 4.0 and 5.1 and containing plenty of organic matter, fill the tubs with it. If such soil is not available, obtain bales of acid peat moss and mix three-fourths peat moss and one-fourth of the soil present in the garden. Baled peat moss having a pH of 4.0 is available in most places.

Plant one blueberry plant in each tub. Do not mix fertilizer in the soil or put in plant holes. A month after planting, fertilize each plant with one ounce of complete garden fertilizer dissolved in water. Apply fertilizer each spring thereafter at the rate of one ounce of fertilizer per year of age, but not to exceed a total of six or seven ounces per plant when full grown. Apply water as needed to keep the soil slightly moist.

Birds know a delicious morsel of food when they see it and unless the plants are covered with netting as soon as the berries start to turn color, the birds will harvest the crop ahead of the gardener.

While this method of growing blueberry plants in the garden requires effort and extra expense, plants can be grown in tubs that will attain a height of six to eight feet and will produce a lot of berries. An added pleasure is that the blueberry plant is a beautiful ornamental shrub and is attractive at any time of the year.

Can You Pick Better Beeves?

Condensed from The Michigan Farmer

E. D. Farwell

STRONG 4-H club fat steer shows have helped to develop a great interest in beef cattle judging at our Michigan fairs during the last few years. However, many fair visitors do not understand beef cattle judging simply because there are no beef herds in the locality in which they live. By knowing a few of the principles of judging, most people will enjoy watching the judge place these classes of heifers, bulls and steers.

Most judging coaches consider it easier to teach beef cattle judging than the judging of sheep, swine, or horses. Sheep have wool which hides many features. Hogs have changed in type several times. Horses are used for several purposes and have many more points to consider. Beef cattle are raised to produce meat and the animal with the most of it in the tightest package is generally the best.

Let us consider the fat steer classes first. Here we have the 3 major points—finish, type, and quality. Finish is of great importance in judging steers. Rarely is a steer too fat, although he may

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lack quality for being soft or unevenly finished. Top grade beef comes from carcasses of highly-finished steers and heifers. Fat in meat improves the flavor and tenderness.

Judges handle steers to see how much fleshing they carry over the outside of the body. They feel for finish along the top, especially over the top of the rib, across the loin, and over the rump. The fattest steers will usually be well covered down over the ribs, especially on the lower parts. Some judges check to see how much flesh covers the point of the shoulder and the hip bones. A full, thick flank is also a good indication of the amount of finish. Finish on steers should be firm yet should not be hard. Sometimes a judge refers to a steer's finish as being "harsh" or too hard as contrasted with a "mellow" finish which is desirable. Mellowness indicates a cushion of fat not only over the muscle but also within the muscle which is needed for a top grade carcass.

Correct type or confirmation in beef cattle is most often compared to a rectangular block placed on edge. Essentially a steer should be wide, deep and short. The width should be uniform from front to rear and should carry out especially thick over the rump and through the quarters. Many steers are narrow across the loin, which is the most expensive cut. Steers should not only be deep-bodied but also low set. Short legs are necessary for a low set animal. Depth through the body should also be uniform. Frequently steers are shallow in the chest or high in the rear flank. Both the top and bottom lines of beef animals should be straight and these lines should be parallel. Get behind the class and notice the depth of twist. This is where the hind quarters join and it must be deep to give heavy, deep rounds. Balance is also important in judging beef cattle. The body parts should be well-proportioned and should blend together smoothly.

Quality in fat cattle is shown by trimness throughout, uniformity of fleshing, hide, hair, and bone. Steers should be trim about their heads and necks, free from heavy coarse briskets and trim about their middles. They should be uniformly covered with firm, smooth finish and should have thin, pliable hides. The hair should be smooth and silky and the bone refined. Steers with excessive middles are often called "paunchy" and will be wasty, giving a low dressing percentage. Hides are not as valuable per pound as beef so the hide should be thin. Steers that are unevenly finished often are called "patchy." Style is valuable as we all like animals that are attractive. Smooth steers with silky hair certainly appeal to us.

Now let us take up the breeding classes. Finish is no longer the big point and we have to consider several other things which contribute to the value of breeding animals. Type is the same for all beef cattle so it is not necessary to repeat what has already been discussed. However, it is by far the most important factor in judging breeding classes. Quality has also been discussed and it should also be considered when judging breeding classes. The other points to discuss are: Feet and legs, breed and sex character, and natural fleshing.

Feet and legs are very important if beef cattle are to live and produce over a long number of years. The legs should be set squarely under the 4 corners of the body. The bone in the legs should be wide and strong with clean joints. The feet must be free from growths and attached to strong pasterns. Beef cattle need to be active and able to move easily as they must be able to graze over large areas of grass to produce efficiently.

Breed character is determined by those points which distinguish the breeds from each other.

These points are chiefly color. Shorthorns vary from solid white to a solid mahogany red, and red and white spotted and roans in-between these solid colors. Herefords are red with white faces, a white stripe along the top of the neck and white feet. Aberdeen-Angus must be solid black. The Angus are always polled but there are both polled and horned breeds of Shorthorns and Herefords. The Shorthorn bull is supposed to have a burly head while the Angus should have a smoother head. Breed character combined with type is frequently referred to as breed type.

Sex character means masculinity or femininity. Breeders want their bulls to have masculine heads and necks. They also want sweet-headed heifers, which means feminine heads. Bulls should be rugged with strong bone. A short, thick neck with enough crest to show sex is desired in a herd sire.

Natural fleshing is important in beef cattle. The tendency to lay on fleshing easily under the same feed and management conditions indicates an easy feeder. This fleshing should be uniformly distributed.

With this brief review of beef cattle judging in mind, let's not miss looking over the fence while the judge is awarding the blue ribbons at the county fair. And remember a large difference in some small point may be more important than a small difference in a major point.

Raising Calves Without Whole Milk

Condensed from The Southern Planter

THE U. S. Department of Agriculture estimates that over 5 million heifer calves are reared each year for future dairy cows in the United States. They are fed tremendous amounts of whole milk and skim milk during their early months. In fact, at the feeding rates usually recommended, the average for each calf would be about 550 pounds of whole milk and 2,900 pounds of skim milk. Thus, the 5 million calves would consume 95 million pounds of butterfat from the whole milk and 17 billion pounds of skim milk.

It stands to reason, that if a successful calf-feeding program could be devised whereby less emphasis would be on milk and more on grain and roughage, the dairy farmer would have more milk to sell as human food.

For nearly 20 years, Henry T. Converse of the U. S. Bureau of Dairy Industry experimented with calves at Beltsville, Maryland; to determine their minimum requirements for whole milk and to find out how soon they can be weaned from skim milk to hay and grain rations.

His research has shown that dairy calves can be raised successfully from birth without any salable whole milk and with a limited amount of skim milk, provided the skim milk is supplemented with cod-liver oil or some other source of vitamin A.

Moreover, Mr. Converse concluded from his experiments that calves are often fed more milk than they actually need for proper growth and development and that it would be more profitable on many farms to sell the excess milk for human use, particularly when milk prices are high.

If you follow the orthodox recommendations for feeding calves, you probably do about as follows: Feed the new-born calf colostrum (mother's) milk for 2 or 3 days, follow with whole milk for 2 to 4 weeks, gradually substitute skim milk for the whole milk over a period of a week or 10 days, and then continue feeding skim milk to 6 months of age. This adds up to the 550 pounds of whole milk and 2,900 pounds of skim milk.

In the Beltsville experiments, however, calves made satisfactory growth when fed no whole milk at all and only 280 to 460 pounds of skim milk. The calves received colostrum milk the first 3 days and were then changed immediately to skim milk. The skim milk was supplemented with vitamin A in the

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Richmond, Virginia, June 1950

form of either carotene in oil, 7 ounces of grated garden carrots, or 2 to 4 teaspoons of codliver oil daily. No dried milk, dried blood, or other animal protein supplement was fed.

The Holstein calves were weaned from skim milk at 30 to 60 days of age, and the Jerseys at 45 to 60 days of age.

Leafy, fine-stemmed hay, such as second-cutting alfalfa or an early cutting of a clover and grass mixture, and a palatable, high-protein grain ration were offered to the calves by the time they were 10 to 12 days of age. Also, an abundant supply of clean water was kept before the calves at all times.

Feed consumption records maintained by Mr. Converse show that the early weaned calves did not use more total digestible nutrients per pound of grain in body weight than did calves that were fed skim-milk to 6 months of age.

Some of the earlier weaned calves obtained as little as 3 or 4 per cent of their T.D.N. from milk during the first 6 months, whereas calves that were fed skim milk to 6 months of age usually obtained nearly a third of their T.D.N. from milk during the same period.

This indicates that nutrients from grain and hay are as satisfactory for calves during the second and third months, and also in later months, as the nutrients from milk. The calf getting milk, grain, and hay eats a little more nutrients than the early weaned calf eats immediately after weaning and, therefore, makes a little larger gain in body weight. Most of the early weaned calves, however, reached normal weight before they were a year old, and some before 6 months.

On the basis of these experiments, Mr. Converse says the total amount of feed needed to 1 year of age by calves that are weaned at 30 to 60 days of age will be about as follows:

Holsteins will need 200 to 400 pounds of skimmilk, 475 to 550 pounds of grain, and 2,800 to 3,500 pounds of hay. Jerseys will need 350 to 450 pounds of skimmilk, 450 to 550 pounds of grain, and 2,000 to 2,500 pounds of hay.

This Fence Wears Its Own Roses

Condensed from Eastern States Cooperative

ARE you looking for fencing that is inexpensive, attractive, requires no upkeep and will keep your livestock where you want it? Then consider a living hedge fence of multiflora rose. Multiflora rose is a thorny, long-lived shrub, easy to establish and inexpensive to maintain. In good soil and with proper culture it will provide a cattle-proof barrier in two to three years and aid soil conservation besides. It may be planted wherever you want to prevent soil blowing, snow drifting and wind damage. Planted alongside ditches and pond banks and across gullies and irregular soil surfaces, it prevents soil washing and erosion. It does not have to be pruned, clipped, trimmed or supported. Also, no serious effects have been noticed either from pests or disease.

Multiflora rose, as its name suggests, is a many-flowered shrub. Originally, the plant came from Asia and until some years ago it was generally unknown in this country as a living fence. It has been used by rose growers as understock on which to graft garden varieties of roses. Its comparatively new use for soil conservation and erosion control and as a livestock barrier has resulted from successful trials and experiments conducted by the soil conservation service of the USDA.

Multiflora rose grows to about eight feet in height and spreads seven to eight feet in width. In four to five years it reaches maturity and does not grow any more. Old canes die and new ones take root. The mass of canes with their stiff thorns tends to make the growth denser and more impenetrable without further spreading. Growth is somewhat umbrella-like. Canes shoot up four to six feet or more, then begin to droop, the slender ends of the canes hanging almost to the ground. Drooping canes, if they touch exposed soil may take root and grow. Ordinary care of adjacent ground by cultivating, plowing or grazing will keep the hedge fence from spreading where you don't want it.

The rose blooms every year for two to three weeks beginning early in June. Clusters of reddish-brown berries appear later which stay on the shrub until they are displaced by new buds in the spring.

Like most plants multiflora rose grows best in deep, fertile well-drained soils. For best results it should be planted early in the spring or late fall. One-year seed-

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lings are considered best for planting. Plants with a stem diameter of one-eighth to one-fourth inch and with well-branched roots six to nine inches long are ideal. Tops should be cut off before planting, leaving just a two- or three-inch cane to limit new growth to about three or four buds.

Hand planting is recommended in a plowed and furrowed strip with a back furrow in the middle. The cultivated strip should be about eight to 10 feet wide. It may be prepared by back-furrowing and then bed-furrowing followed by disking. Plants should be placed in a furrow made on the slight ridge in the center of the strip. Rows of plants should be at least two feet from the unplowed edge of the strip. Transplanting machines used for setting tomato, tobacco and tree seedlings are also good for planting multiflora rose.

Space plants from six to 12 inches apart; six if a barrier for pigs and sheep is desired and at one-foot intervals for cattle and horses. Weather and soil permitting, seedlings should be planted immediately. Otherwise roots and packings should be wet down and not exposed to sun and wind for even a short time.

Directly after planting liberal mulching will help to suppress competing grass and weeds. Hay, straw or any other litter makes a satisfactory mulch. Mulching substitutes for cultivation, and helps retain soil moisture and prevents strong weed and grass competition. It has been found that good soil preparation, timeliness and thoroughness in planting and mulching or cultivation the first one or two years is more important to the vigorous growth of the shrub than fertilization. Topdressing with manure or a complete fertilizer, however, will help growth the first year. Early cultivating and mulching will help the plant to grow faster and become useful in a shorter time, but it does not affect the final maturity and denseness of the hedge.

In most plantings there will be some losses. If two or more adjacent plants die they should be replaced at the next planting season. The easiest way to replace missing plants is to bend over an adjacent cane and cover it with soil where the new plant is wanted.

Rose hedges can be successfully developed with the minimum of care, and in a few years you have a rugged and attractive fence.

Beef At 3 Cents A Pound

Condensed from Capper's Farmer

George A. Montgomery

OKLAHOMA has found a way to make beef at 2 to 3 cents a pound. It seems impossible, but that has been the cost of extra gains made by application of lime and fertilizer when land of low fertility has been turned back to grass.

These results are from the pasture-fertility research station in Coal county, where Horace J. Harper and other men from Stillwater are studying various grassland problems. Nine pastures, ranging from 8 to 22 acres, include 4 types of soil common to overfarmed areas of the South: (1) A deep, permeable upland prairie soil, deficient in minerals; (2) prairie upland with tight claypan subsoil; (3) creek bottom of low fertility; (4) shallow, sandy timber soil damaged by erosion.

The deep upland prairie-type land was divided into 3 pastures. Each contained 18.1 acres. All were sodded to Bermuda and seeded to ryegrass, a mixture of clovers and Korean lespedeza. The latter was seeded in the spring of 1946. Grasses and the other legumes went in the previous year.

One of these pastures got no soil treatment. It has averaged 60 pounds of beef an acre annually the last 4 years. Another was limited 2 tons an acre before seeding. Its average has been 83.2 pounds of beef an acre annually. The extra 23.2 pounds, which can be credited to liming, cost less than 2¼ cents a pound. The third got 150 pounds of 20 percent superphosphate an acre in addition to lime. Its yearly beef production has averaged 109.8 pounds an acre. Seventy cents worth of phosphate made 27.6 pounds of beef. Cost was about 2½ cents a pound.

It was hard for me to understand what made these cheap increases possible until I saw the pastures in late April last year. The untreated one had a good stand of grass, but legumes were scarce. The limed field had a sprinkling of clovers. More feed was available even tho it was carrying 2 more steers. The limed, phosphated pasture had a dense stand of deep-green clover! More than a dozen legumes had been seeded there, but big hop clover had emerged as the dominant species. Grass was present, too, but it was hidden by clover.

Untreated soil was too low in

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Topeka, Kansas, May 1950

minerals to grow good legumes. Those present were unthrifty. Lime helped a lot, but alone it was not quite half as effective as when teamed with phosphate. Both are needed to make clovers boom. It takes legumes to make high protein herbage; and protein is required to make cattle fatten.

Good to choice 400-pound calves for the tests were bought in the fall of 1946. They were grazed 3 summers and were sold in July, 1949. Those on the limed-phosphated field gained 75½ pounds more apiece during the 1949 grazing season than steers on untreated land, tho all were wintered alike. That pasture also had higher carrying capacity and steers grazing it had enough more finish to outsell those on the untreated field by $1 a hundred, and those on limed land by 62½ cents.

The extra finish was due to extremely rapid gains—3.18 pounds a steer daily—made during the final 80-day grazing season.

Value of beef produced in 3 years on the 18.1-acre pastures ranged from $667.89 for the untreated one to $1,281.86 for that which received lime and phosphate. Production of the limed tract was $942.86. That means lime stepped up returns $247.97, and phosphate boosted them $339 more.

"Pasture profits hinge on herbage quality," Harper said. "Tell me how much protein a steer gets each day, and I'll tell you about how fast he will gain and what kind of finish he will put on."

Protein content of the herbage has been analyzed several times each season. Quality of feed and gains are highest from April 15 to June 1. Both drop as the season advances.

Lowest gains came from shallow sandy soil that had been in forest. Row-crop farming had depleted fertility and caused erosion that ranged from moderate to severe. This land was fenced into 3 tracts —one of 22 acres and 2 others of 11.3 acres each. All were seeded to weeping lovegrass and legumes. One small field had no soil treatment. The other got 1½ tons of lime and 200 pounds of 0-14-7 an acre. Added soil minerals increased gains at a cost of 3 cents a pound.

Untreated timber soil produced only 47.6 pounds of beef an acre annually. That was a little more than three fourths of the gain made on untreated prairie soil.

Lower gains could have been due partly to the grass species. The upland prairie was in Bermuda; the timber soil in weeping lovegrass, which is known to be lower in nutritive elements than most pasture crops.

One striking difference between this pasture and others was its effect on the cattle. All were wintered alike. Their average gain in

3 years was only 439½ pounds. That is 232¾ pounds less a steer than was made on the same kind of soil after it received lime, phosphate and potash. One steer was only 402 pounds heavier when sold after 3 summers on pasture. Gain was less than ½ pound a day. Poor pasture not only cut gains, but lowered grade. He and a pasture-mate (the 11.6 acres carried only 2 animals) averaged 850 pounds. That is 166 pounds less apiece than the average of the next lightest lot and it is 271 pounds below the average of the heaviest lot.

The 2 highest yielding pastures were creek bottom. Both were limed, but only one was phosphated. The field getting both treatments produced 175.2 pounds of beef an acre annually. That is 23.2 pounds an acre more than the yield on bottom ground that got lime only. Extra gains produced by phosphate cost about 3 cents a pound.

Phosphating creek bottom that had been limed made it produce $37.66 worth of beef an acre annually. Phosphate boosted the season's returns $5 an acre.

Prairie-type land with claypan subsoil, when limed and phosphated, produced gains of 106.5 pounds of beef an acre annually. That's only a little less beef than came from more permeable upland that got the same treatment.

There are millions of acres in this country much like these Oklahoma soils. This land lies in a wide band that stretches from eastern Texas, eastern Oklahoma and eastern Kansas to the Atlantic seaboard. Much of it is marginal for production of cultivated crops. It is in an area of plentiful rainfall, and it can be made to produce meat profitably.

Clipping Needle Teeth May Harm Baby Pigs

The experts tell us that we ought to clip the needle teeth from newborn pigs. It prevents injury to the sow's udder and to other pigs.

Unclipped pigs often get sore mouths and swollen noses—a sign of "bullnose," caused by germs in manure and barnyard filth.

But clipping the needle teeth is only a good thing if it's done without harming skin or gums. Otherwise, the injury from the clipping might be worse than if you left the teeth in, say veterinarians at the University of Illinois.

—*Farm Journal*

Mobile Soil-Testing Unit

Condensed from Better Crops With Plant Food

L. C. Olson
Georgia Experiment Station

SINCE the soil-testing program was begun at the Georgia Experiment Station in 1938, its popularity has grown rapidly. During the early years of this service only a few hundred samples were analyzed annually for fertilizer and lime requirement, but during the last few years 15,000 to 20,000 samples are tested tested each year.

There are several reasons for the increased demand for this service by the farmers and growers of the State. Without the use of reliable methods of analysis and accurate interpretations of the results based upon a large number of field experiments, this program doubtlessly would have been a failure. In changing over from crops such as cotton and corn with which they were familiar to pasture and truck crops, growers have had to rely on soil tests and other information to determine the fertilizer and lime needs of these new crops. A general educational program in Georgia as well as in surrounding states has further pointed out the importance of soil testing to the farmer.

Tests are made without cost to residents of the State for acidity, nitrogen, phosphorus, potassium, calcium, magnesium, manganese, and aluminum. A large percentage of the samples are collected by county agricultural agents, Soil Conservation Service personnel, teachers of agriculture, and other trained agriculturalists, although more and more farmers are becoming interested in collecting their own samples. Schools and short courses for the purpose of instruction in collecting soil samples are conducted in various parts of the State periodically.

Results of the chemical analysis, together with an interpretation of the results and recommendations for the specific crop to be grown, are sent out for each sample submitted. In the laboratory, the data for each sample are recorded on cards which are filed according to county. From these cards valuable information regarding the fertility status of the soils in various sections of the State has been obtained.

A recent innovation in soil testing in Georgia has been the introduction of a Mobile soil-testing unit. This unit, which is housed

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in a standard commercial panel truck, was put into operation on October 17 of last year. Since that date, 25 counties have been visited and several thousand samples analyzed in the unit. This laboratory is equipped with standard laboratory soil-testing equipment and the same tests are made on the truck as are made in the laboratory. One technician and one agronomist have been analyzing from 75 to 100 samples daily in this truck, and sufficient chemicals and supplies are carried for one week's operation.

One of the chief advantages of the Mobile soil-testing unit is that of saving from one to two weeks' time in getting the results of the analysis back to the farmer. The truck is located at a central point in the county and farmers bring their samples to the truck. While they wait, their samples are analyzed and the results and recommendations given to them. The educational value of this procedure is important. Many farmers have been convinced of the value of soil analysis by seeing their samples tested. Another advantage of this method of soil testing is that gained by the man-to-man conversation which is obviously much better than correspondence that is often confusing, time-consuming, and expensive.

In addition to the routine testing of soils for fertilizer and lime requirement, the Mobile unit will be used for trouble-shooting in areas of the State where farmers are having difficulty, for demonstration, plant-tissue testing, and for locating fields suitable for experimental plots.

The outlook for mobile soil testing in Georgia is bright. Already another unit, a route van, has been obtained. This second unit will be in operation before July of this year. Each unit is capable of analyzing from 10,000 to 15,000 samples annually at a cost comparable to that when the analysis is made in a central laboratory. It is believed that six such units could take care of the needs for the entire State. The advantages of this type of soil testing, such as more rapid results, a greater educational value, and more accurate recommendations due to a better knowledge of local conditions, cannot be overlooked. The only disadvantage at the present is that the demand for "soil testing on the spot" far exceeds present facilities for doing it.

More Lambs Earlier

Condensed from Sheep Breeder

D. Steve Varner, M.S.

REPRODUCTIVE failures among all classes of livestock constitute a major problem in all localities. A survey of the literature leaves no doubt that faulty nutrition may affect the fertility of animals. Up to forty years ago, nutrition was measured in terms of protein, carbohydrates, and minerals. Then came the vitamins. Recent discoveries of hormonal activity in fresh wheat or in wheat germ oil opens a new field of knowledge that may explain many breeding failures.

Normal reproduction and lactation in domestic animals are regulated by hormones, a group of chemical materials that are secreted by the endocrine glands. The hormones of wheat germ oil are chemically similar to the hormones of the sex glands. In each case they are biologically active steroids. Experiments have shown the presence of androgenic and progestational activities. Estrogen is normally secreted by the ovaries and is necessary for the implanting of fertile eggs in the female reproductive organs. Progesterone helps to maintain the fertilized egg while it is developing into the young animal as we see it when it is born. Both estrogen and progesterone influence the growth of the udder. The increased livability of new born animals whose mothers were fed wheat germ oil is a field in which little research has been done, although practical livestock raisers have had excellent results in this field.

For over seventeen years solvent extracted wheat germ oil has been used successfully by livestock raisers to correct nutritionally caused reproductive failure. Roger Woebbeking, Woodburn, Indiana 4-H boy and prominent breeder of registered Hampshire sheep, has been feeding Rex Wheat Germ Oil for three years, "to get earlier lambs," and to "reduce lambing troubles." After weaning he feeds two ounces per ewe per month through pregnancy. He has been able to lamb as early as September.

Mr. C. E. Starkweather of Crozet, Virginia has had an experience using the oil during breeding season and prior to lambing. He reports with his flock of registered Hampshires a 125% living lamb crop that were an unusually thrifty bunch of lambs,

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Chicago, Illinois, August 1950

with a goodly number of twins, and that all lambs came in January and February.

Shepherds have been using flushing of ewes for years to stimulate all the vital functions, including the breeding function, to greater activity. Flushing—feeding the ewes so that they are in a gaining condition at mating time—increases the lambing percentage. At various times of the year, feeds may become old or rancid and destroy certain fresh factors and hormones originally present. These essentials must be replaced. Quoting from the USDA Bulletin on the flushing of sheep—"It is a common observation that the twin lambs in a flock are produced chiefly in the early part of the lambing season. In 302 cases with Southdowns, 78% of the twins were dropped in the first half of the lambing period and flushing gave an 18% increase in the number of lambs dropped."

From the practical viewpoint, flushing ewes with fresh feeds and wheat germ oil causes the ewes to breed earlier, giving a higher lambing percentage, and shortening the period over which the lambs drop. Early lambs, uniform in age, require less care and return more profit. Much of the confusion and failure which confronts the feeder who flushes his ewes with old grains, can be avoided with fresh feeds and succulent pastures.

Might not the regular addition of wheat germ oil that contains hormone activity of estrogen and progesterone in a balanced, natural state, be expected to improve the reproductive health of normal sheep that are not producing up to their maximum efficiency? I believe it would!

Screwworm Control

A mixture of DDT, lindane and xylene solvent is giving encouraging results in screwworm control in Texas ranch trials. It works on cattle and sheep and various animals afflicted with screwworms. Advantage of the material is that it drives worms from the wound and induces rapid healing.

Newborn lambs, calves and pigs have been treated with the screwworm remedy with no ill effects. It is said to control fleece worms also. It does not stain wool nor mohair.

—Cappers Farmer

How To Get 40% More Pasture Time

Condensed from New Jersey Farm and Garden

Dr. M. A. Sprague
Rutgers University

DAIRYMEN have been getting a lot of advice in recent months on how to cut costs in view of present unfavorable milk-feed ratios. One of the easiest and fastest means I know is to use small grains in the pasture program. Rye, sown in late August or early September, will be ready for grazing in early October. In most years this will enable cows to graze until the middle of November—even into December. What's more, rye will be ready to graze again early in April and will afford about three weeks of grazing before the permanent pastures are ready to furnish good grazing.

Assuming you have a normal grazing season, with good permanent pastures, the use of small grains like rye will increase grazing time by about 40%! Well-fertilized rye should be planted September 1 in Central New Jersey, a little later in South Jersey and Delaware, and a little earlier in North Jersey. If in doubt as to time in your locality call your county agent.

No matter how well you feed your cows in the barn they will go up in production when put on pasture. Most dairymen find it best to graze their animals only a few hours a day when they put them out in the spring, but they immediately note a rise in milk yields. In this way a few acres can support more cows in early spring.

C. R. Grigsby, in Somerset County, grazed 19 steers on 10 acres of rye last fall. It was the first time he had tried rye for grazing. He liked it so well he is planning to put 27 acres (nearly a quarter of his farm) in rye this coming season. The steers grazed the rye in preference to anything else and improved their summer condition so much that they were almost ready for market in December.

He estimates that each animal gained over two pounds per day while on rye. This spring 40 steers grazed the same acreage for more than three weeks prior to the time permanent pastures were ready.

Extra nitrogn on the grains pays off in more grazing. About half of Grigsby's rye was treated with 100 pounds of 16% nitrate of soda per acre in late winter. The treated area gave 71% more forage, even though he fertilized well

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Sea Isle City, New Jersey, July 1950

with 5-10-10 at time of planting.

Rye will provide almost twice as much grazing as barley and wheat when grazed both fall and spring, and nearly three times as much as oats. Fall-seeded oats grow too slowly and winter-kill too easily to do well for pasture in New Jersey. No special varieties of wheat and barley are used for forage; those recommended for grain do well.

Common and Balbo rye do well under New Jersey conditions. Seed about a week earlier in the fall then when seeding for grain, and use at least two bushels of seed per acre of rye, wheat, or barley when planning to graze your small grains. Use a complete fertilizer high in nitrogen for best results. Six hundred to 800 pounds of a 7-7-7, or the equivalent, is adequate on most soils.

Extra nitrogen at the time of seeding provides more and quicker grazing in fall and increases the protein content of the forage. On fertile soils, plan on about one acre of rye for each four or five milking cows you intend to pasture. On poorer soils—and when using wheat or barley—more acres are required to furnish adequate grazing.

Antibiotics Make Good Feeds Better

Condensed from Turkey World

Dr. James McGinnis
Washington State College

It now appears that the use of antibiotics such as terramycin, aureomycin, streptomycin, and penicillin as a supplement to turkey starting diets may clarify many confusing and conflicting results which have been obtained in various laboratories in the years past. For example, about five years ago an experimental diet was fed to turkey poults with excellent results being obtained. This same experimental diet mixed from new ingredients was fed in another experiment last year. The results were anything but satisfactory. A similar type of diet has been fed in experiments recently with the exception that antibiotics were added as a supplement. The results were again extremely satisfactory.

During the summer of 1949 some experiments with turkey poults were designed to compare the growth promoting effect of a liver fraction rich in vitamin B_{12} with some of the fermentation ani-

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Mount Morris, Illinois, July 1950

mal protein factor feed supplements. The vitamin B_{12} supplement failed to promote growth of the turkey poults, when added to a soybean oil meal type of diet. In contrast, the fermentation APF supplement gave approximately a 40 percent increase in growth of turkey poults fed a diet containing soybean meal as the only source of protein, or when added to a diet containing a combination of soybean meal with fish meal.

It seems that the most probable reason that the B_{12} supplement did not promote growth was that the poults had enough B_{12} stored in their body through the egg to permit a satisfactory rate of growth. The ration fed to the breeders from which the poults were produced contained a relatively high level of fish meal.

In an experiment conducted this year, the turkey poults were hatched from breeders fed an all-plant ration containing soybean oil meal. Only a slight growth response to vitamin B_{12} was obtained. Again, this failure to obtain a marked response in turkey poults to vitamin B_{12}, such as that which is obtained with chicks, is attributed to the probability that the poults had significant storage of B_{12} at the time of hatching. A pure antibiotic added to the same diet gave a marked increase in growth.

Following the demonstration during the summer of 1949 that some of the fermentation APF supplements gave a marked increase in growth, a number of experiments have been conducted with chicks in an effort to find out what the unknown growth promoting factor was. Fractions were made from products resulting from the fermentation production of streptomycin, terramycin, and aureomycin. All of these fractions had growth promoting properties for chicks. Previously, this increase in growth had been obtained only with products resulting from aureomycin production. This finding demonstrated that the "unknown factor" in the aureomycin APF supplement could also be obtained in the production of streptomycin and terramycin.

Within a short time after this announcement was made at the Oregon Nutrition Conference in Corvallis, Oregon, it was found by the group at Lederle Laboratories in Pearl River, New York, that aureomycin (the antibiotic itself) promoted growth of both chicks and turkeys when added to an "adequate" diet. Since that time a large number of experiments have been conducted at Washington State College with turkey poults and chicks. The pure antibiotics, such as terramycin, aureomycin, streptomycin, and penicillin, have been used in these studies. All of them have been found to be markedly effective in improving growth of turkey poults

fed a practical type of diet containing soybean oil meal and 10 percent of herring fish meal as the source of protein. *It should be emphasized that this added growth has been obtained by adding the antibiotics to the best type of turkey starting diet that we could formulate from ordinary feeding ingredients.*

The actual requirement of turkey poults for the different antibiotics may prove to be a variable figure depending somewhat on the type of diet which is being fed, and the conditions under which the turkey poults are kept. A considerable amount of research will have to be conducted along this line before requirement figures can be given that may be applicable under practical feeding operations. However, the results of a number of experiments indicate that as little as 10 to 15 parts per million of aureomycin and terramycin are effective, and that streptomycin may be required in slightly higher amounts. Penicillin appears to be the most effective of these four antibiotics in promoting growth.

It was reported in 1949 by Moorehouse of Salsbury's Laboratories that a compound having the chemical name, "3-nitro-4-hydroxyphenylarsonic acid," was effective in promoting growth of chicks and turkeys when added at low levels to a practical feed. Results obtained at this station also show this compound to be effective in promoting growth of turkey poults to four weeks of age. In the one experiment in which this material was used, it compared favorably with some of the antibiotics.

In the experiments conducted this year using antibiotics, one of the most striking effects has been great reduction in mortality and in "stunted" poults. It seems that the turkeys began eating much more promptly and continued to eat when the feed contained antibiotics. There have been very few "starve-outs." It has been estimated that the financial savings that are possible through reduction of poult mortality in one year's time would far more than pay for all of the research that has been conducted on this problem.

The addition of antibiotics to a turkey starting ration has resulted in a marked increase in feed efficiency.

Because of the effect which antibiotics have on the moisture content of droppings, it has been much easier to keep brooder house litter in excellent condition. This effect is of great practical importance and significance since much less labor is required in the brooding of turkeys to stir litter, clean houses, and add new litter. Because of the lower moisture conten of the litter, it seems that difficulties arising as a result of high moisture in the litter should be reduced to a great extent.

The question of how the antibiotics have a growth promoting effect has been asked many times. At the present stage of research on this problem, a specific answer cannot be given. However, there are a number of suggestions or possibilities that seem to have considerable merit:

1. A modification of the intestinal flora or microorganisms. The fact that so many different antibiotics are effective in promoting growth lends support to this possible means of action. Whether or not the modification is eliminating bacteria which have been harmful, or permitting other bacteria to grow which produce vitamin-like factors in the intestine, has not been determined at this time.

2. Elimination of competition for nutrients between microorganisms and the host animal (turkey poults). The increased feed efficiency which has been observed when antibiotics are added to the diet suggests this possibility.

3. Elimination of microorganisms from the intestines which are mildly pathogenic under different conditions.

When the final answers are known, we will in all probability find that the antibiotics are having a growth promoting effect because of a number of different reasons, or possibly a combination of the above possibilities.

Buttonclover—A Great New Plant

Condensed from Soil Conservation

Barrington King
Soil Conservation Service, Spartanburg, S. C.

Farmers in the northeastern and northwestern Alabama soil conservation districts are pushing another new plant in the long list of those that are helping to revolutionize Southern agriculture.

Buttonclover (*Medicago orbicularis*) has made such phenomenal progress as a reseeding winter legume on cropland in the vicinity of Huntsville for the past few years, that the Alabama Buttonclover Growers Association celebrated with a buttonclover festival in April. After seeing a lush growth of the new plant on tours of several farms during the day, visitors from several surrounding States heard its virtues extolled at a dinner in Huntsville that night.

One reason farmers in the

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Huntsville area like buttonclover is that it lies close to the ground and provides good protection against erosion before the stand gets crowded and starts its upward growth. In fact, it covers the ground with such a dense mat that "a snake will crawl on top instead of under it." Another advantage is that "it will wait for you to harvest seed."

One of the problems in machine harvesting of buttonclover has been the difficulty of getting the seed of the recumbent, mature plants off the ground with a combine. Development of a pickup reel has eliminated this difficulty. Some of the growers reported harvesting seed as late as the Fourth of July and reported that about 97 percent of the seed are hard after going through a combine.

The high percentage of hard seed produced by buttonclover makes it possible to get a volunteer crop for 3 to 5 years from one seed crop left on the land. This makes it especially valuable in crop rotations. Its value as a winter grazing crop was observed in several fields which had provided grazing from October to April for one cow to the acre. The farmers said they would still get a seed crop from the same land.

Buttonclover got its start in the Huntsville area as a result of a visit to Tennessee by two local Soil Conservation Service workers who were impressed by possibilities of the plant.

Dr. L. R. Neel, editor of *Farm & Ranch-Southern Agriculturist,* who did some of the early work with buttonclover as superintendent of the Middle Tennessee Experiment Station, emphasized the importance of cultivation to prepare a seedbed to enable buttonclover to reseed, and also stressed the plant's heavy lime requirements.

"A farmer can have 7 months' pasture from buttonclover and still get a seed crop," Dr. Neel said. "He can run buttonclover in rotation with corn 2 years out of 3. We know it has withstood a temperature of 17° below zero. One upland field has grown 8 years without any disease showing up. And we know that cattle, sheep, and hogs like it."

John Ewing, assistant director of the Tennessee experiment stations, reported that buttonclover is of European origin and was first found in this country in Wilson County, Tenn., following the visit of a circus to Lebanon. He said the crop requires soil of high fertility and needs inoculation. A special buttonclover culture is available commercially.

Ewing said buttonclover is one of the most palatable of winter crops and does not bloat cattle to the extent that some of the other clovers do. It requires cultivation for effective reseeding and is not suitable for permanent pasture.

He said farmers can save up to 500 pounds of seed to the acre.

Several of the speakers pointed out that buttonclover is but one of many new soil-conserving, soil-building plants that, together, are working wonders in Southern agriculture. It was brought out that buttonclover is not adapted to conditions in all parts of the Southeast.

L. B. Scott, SCS regional nurseryman, said that another new plant, *Medicago obscura*, a close relative of buttonclover, had done well in the Service nursery at Brooksville, Fla., and might have possibilities in other areas. He discussed the seed-increase program of promising new plants in Service nurseries, including buttonclover, which has been in production at the Chapel Hill, N. C., nursery since 1937.

L. L. Self, district extension agent, pointed out that no one crop will solve all the cover and grazing needs. "It's fine to study all possibilities," he said. "We should know the crop before we say to a farmer, 'This is the plant for you.'"

Recalling that during the morning tour the group had seen 750 acres of Kentucky 31 fescue on the G. W. Jones & Sons farm, operated by General Jones and his brother, Carl, the speaker said, "Many years ago we had several failures with fescue and decided it was not suitable as a major crop. Today we'll agree with you that it is."

W. G. Simpson, assistant State conservationist of the Soil Conservation Service, referring to the tours that preceded the dinner, said:

"This has been one of the most heartening days I've had in 25 years of professional agricultural experience. I can remember when it was a long jump between green fields in Alabama at this time of the year. Today it is hardly possible to get out of sight of a green field in this State."

J. C. Lowry, extension agronomist, pursued the same thought. "This is a part of a new day developing in Alabama and the Southeast," he said. "We've worried too long about our problems without realizing our advantages. But a spirit of optimism has developed, a kind of alertness.

"It's going to take a lot of seed to do the job. I can remember, about the time of the depression, when there wasn't a single seed processing plant in Alabama. At the beginning of this year there were 72. There has never been anything in the history of the State like the green cover crops we have today."

Paint—New Life For Buildings

Condensed from Iowa Farm Science

C. H. Van Vlack

Professor of Agricultural Engineering, Iowa State College

It's time to think about painting before another winter sets in. Besides making your home more attractive and satisfying, painting is an investment in the long life of your buildings.

Good paint protects wood and keeps it from checking and warping. Steel and metal work will corrode unless covered with rust-preventing paints. Neat, freshly painted buildings also add to the appearance of the whole community.

The paint you use should be made to withstand hard wear. It has to stand up under rain and snowstorms, hot sunshine and sub-zero weather. In summer the temperature on the sunny side of the house may reach 120 degrees. The paint film must be tough and elastic or it will crack when the wood expands and contracts with changing temperatures.

Consider the cost of house paint on an annual basis rather than on the total expense of a paint job. A high-quality paint will of course be more expensive than one of low grade. But very few materials provide as much durability and service as a film of good quality paint. It will wear much longer and give your buildings better protection, and will cost less in the end than low-quality paint.

A high-quality paint is made up of an oil, or binding liquid, mixed with a powder in a dry or paste form known as pigment. The pigment colors and hides the surface. The durability and good consistency of paint depend a lot on the pigments. To form a good protective film, the pigment should be opaque in linseed oil. Some pigments become almost transparent in the oil. These are called fillers or extenders and are used to reduce manufacturing costs. Cheaper, less durable paints contain a large amount of fillers.

Iron oxide, a red pigment, is very durable if not too much filler is added. It's inexpensive and practical for barn-lot buildings. Red lead is an excellent rust preventative and is most durable for metal painting.

The liquid part of house paints should be linseed oil or soybean oil. The rest may be made up of thinner and paint drier. When pure linseed oil is exposed to the air, it changes from a liquid to a

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Ames, Iowa, July 1950

flexible solid film. Because it resists moisture and is tough and elastic, it's an ideal binder to hold the pigment to the surface of the wood.

The thinner helps the paint to penetrate the surface and leaves a flat finish. Pure turpentine is best. Some low-grade paints use "mineral spirits," "mineral turps," or even gasoline or kerosene. In some cheap paints a large amount of thinner and less linseed oil are used.

And how can you be sure you are buying good paint? Look for labels telling the contents of the paint. Most reliable paint manufacturers print on their labels the name and percentage of each kind of pigment and liquid used in making the paint. If this formula isn't given, you have reason to doubt the quality. You can usually count on getting good supplies when you buy the better-known brands.

The most common transparent pigments used for filler in low-grade products are calcium carbonate, silica, magnesium and aluminum silicates, calcium sulfate, barium sulfate and lithopone. If you see these names on labels, there's reason for doubt.

Note the label proportions of the pigment and liquid. To be really durable, house paints should contain a greater percent of pigment than liquid by weight. In cheap liquids some of the substitutes for linseed oil are fish oil, oriental oil, paint oil and boiled oil.

To tell how much paint you need for a job, first figure the area to be covered. If you're painting the whole outside of a building, measure the distance around the building and multiply this by the height, not including gables. Calculate the gable area by multiplying the height of the gable by half its width. For porches, take the length times the width. Add these sums together for the total area to be covered.

To find the number of gallons of high-quality paint required for the job, divide the total area by the number of square feet a gallon of paint will cover. If you're painting a new surface, use 700 as the number of square feet a gallon will cover for each coat. For repainting old surfaces, figure 800 square feet per gallon for each coat.

If you choose to save money by mixing your own paint, find the approximate amount of paste white lead needed. First divide the area to be painted by the average number of square feet a gallon will cover. This will give the gallons of paint required. Next find the pounds of paste white lead needed for each coat. Do this by dividing the number of gallons by 6 and multiplying the result by 100.

Finally, figure the total pounds of paste white lead for the whole paint job by multiplying the

pounds needed for each coat by the number of coats. Remember that 50 or 100-pound packages of paste white lead are the most economical. It's always wiser to have too much paint rather than not enough. You can always use leftover paint for odd jobs around the farm.

Before beginning your paint job, make any needed repairs on the building. Badly worn, split and decayed materials should be replaced. Loose paint around peeling or blistered places should be removed with a wire brush or scraper. Old paint which is rough and badly checked should be removed with paste paint removers. Tin work needs to be painted soon after being placed to prevent rust.

Cracks and nail holes shouldn't be puttied until after the first paint coat is applied. This keeps the oil in the putty from going into the wood. If putty in the windows is loose, scrape off the old putty and paint the sash with a coat of thin paint. Allow a few days for drying before reputtying.

Fair weather is the time to do your outside painting. Avoid the job during periods of high humidity. The weather and the surface should both be dry, and the temperature should be about 40° F. When paint is warm it's thinner and goes into the wood more easily. Don't work when the insects are numerous or when dust may be blown badly.

In mixing your own paint, first measure the amount of paste white lead needed for the immediate work. Cover the remaining paste lead with a thin layer of linseed oil and replace the lid tightly. The paste will not deteriorate.

Several smooth wood paddles, a 10-gallon milk can, and a small clean barrel or tub with a cover may be used for mixing. For the priming coat on new wood, mix 3 parts paste white lead, 4 parts linseed oil, and 2 parts turpentine. For the body coat on new wood or repaint work, the formula is 2 parts paste white lead to 1 of oil and 1 of turpentine. In mixing the finish coat, use 1 part white lead with 1 part oil.

If you're going to do the painting yourself or with the use of the farm help, you'll need a 16-foot ladder for a one-story house or a 16-foot extension ladder for a two-story house or large barn. A smaller ladder and some planks and saw-horses will be needed if you have several helpers. Empty white lead containers of the 25 and 50-pound sizes will make good paint pots. Each man should have a long-bristled, 3½ or 4-inch brush for long, flat surfaces. Several 2-inch brushes and an inch brush should be available for painting small areas around windows.

When you're ready to apply the paint, hold a small pot of paint in one hand to save stooping. Dip

the brush and carry the load to the surface, spreading it only enough to empty the brush. Repeat about a half-dozen times, spreading the load over an area about 2 feet wide and 4 to 6 feet long. Then spread out the paint with long, sweeping strokes, brushing under edges of the siding first. Direct your strokes with the grain of the wood. After the paint is well spread out, lay or smooth it off with the fine ends of the brush. Keep a short paddle in the paint pot so an occasional stirring will keep the oil and pigment well mixed.

How well the paint sticks to the surface depends upon how well the oil penetrates. If you use light, jabbing strokes the film does not sink in well. A strong, vigorous brush action forces the paint into the wood cells.

When you're applying the priming coat on new wood, remember you're laying the foundation of the paint film. Brush in thoroughly and lay the paint on evenly. If you're priming soft woods such as cedar and redwood, add more linseed oil in the first coat. This will prevent noticeable laps between stretches where the soft wood has soaked up the oil and left the pigment on the surface.

Under average weather conditions, allow the paint to dry for several days between coats. You can test for dryness by sandpapering a spot on the surface painted several days before. If the film does not gum up the sandpaper, it is ready for the next coat.

Take care of your paint brushes if you want them to do good work. After using a brush, wash it in painter's naphtha, mineral spirits, kerosene or turpentine. Make sure all of the pigment is out of the bristles near the handle. Then wash in soap and water and allow to dry. If paint once gets hard in a brush, it's next to impossible to restore its usefulness.

Store brushes by suspending them in linseed oil, kerosene or turpentine. Bore a hole in the upper part of each handle and draw a wire or rod through the hole, resting the wire on the edges of the pail. Never let a brush rest on the end bristle in a pail for more than a few hours. This will warp the painting edges and make even-spreading impossible.

Everyone who does his own painting should learn to recognize the different kinds of paint failures. You should know how to avoid them and what to do if they occur. Here are the causes and remedies for the most common errors:

Alligatoring is a cracking which looks like alligators' skin. It's caused by putting on a fast-drying coat that's too soft. The softness results from too much oil, inferior oil, or too short a drying time between coats. If formulas for each

coat are followed correctly this failure shouldn't occur. If the cracking isn't too severe, the coat may be removed by wire-brushing. If the cracks are too deep, the old paint should be removed.

Blistering and peeling are caused by moisture in the wood. The sun draws this to the underside of the paint film. The pressure raises the paint from the surface in blisters, and peeling follows. Good paint never blisters or peels if the wood is dry when the paint is applied and remains dry afterward. If a rainstorm wets new wood before it has been primed, let a day of sunshine or wind dry the wood before painting. Before repainting a blistered surface, scrape off old peelings and sand down the rough edges. Touch up the bare spots with a priming coat before the body and finishing coats are applied.

Blotching and fading show up where the wood has absorbed all the oil from the paint. The cause is giving the wood too few coats. Dark colors appear to fade when the oil is absorbed. To avoid faded blemishes, use three coats of properly formulated paint.

Cracking and scaling are usually the result of using a low grade paint that doesn't form a tough and durable film. When repainting, all the old paint must be removed. Otherwise it will continue to scale and carry with it the new paint.

Tackiness and slow drying often results in more serious problems if not avoided. Make sure each coat dries thoroughly before the next coat is added, or checking and alligatoring may result. For quick drying in cold weather substitute some turpentine for a little of the linseed oil. Allow plenty of time for drying.

Wrinkling occurs when paint is applied too thickly. The surface skin dries quickly and leaves damp paint beneath it. When this dries later, it makes the surface skin wrinkle. To avoid this, brush each coat into a thin film. The wrinkled parts may be sanded down before repainting the surface.

Atomic Ranch at Oak Ridge

Condensed from The Cattleman

Richard W. Wallace

THE atomic age with its long, raylike fingers has reached out into every corner of the globe. In the uncertain Summer of 1945 they "touched" a herd of Herefords grazing peacefully on a high mesa near Alamogordo, New Mexico, thus making them the first living casualties of the atomic bomb.

This strange story opened during the drizzly, early morning hours of July 16, 1945, when a tremendous blinding flash seared across the heavens, followed by a sustained awesome roar. The first atomic bomb had been successfully detonated.

The hundred frightened Herefords on the mesa, however, did not realize that the atomic age had just roared in, nor could they have presaged that the solarlike flash meant a drastic change in the course of their lives and the very purpose of their existence.

Their first inkling came four to six weeks later when they were found on the wind-swept mesa deathly ill from a mysterious ailment that left large open sores and blisters and caused large patches of hair to fall out.

Enraged and chagrined ranchers on finding their burned and blistered cattle languishing on the range some weeks later, put two and two together for the well-known four. They promptly contacted officials of the Manhattan Project (Army Engineers' Code name for the atomic plants at Oak Ridge) and found that through an oversight the cattle had not been removed from the test area in time.

However, the Herefords were purchased from their New Mexico owners by "Manhattan" officials and in January, 1946, were shipped to Oak Ridge, Tennessee. A small remnant of the herd was left at the mysterious Los Alamos Laboratory near Santa Fe, New Mexico, for further study and observation there. However, they, too, have since been sent to join their relatives at Oak Ridge.

Very few persons realize that the great bulk of Oak Ridge's 60,000 acres are great open spaces fenced in by the friendly Tennessee hills and mountains. It wasn't too difficult, therefore, to stake out a 3,000-acre ranch for the radiation-stricken Herefords within the

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secret, restricted area of the Oak Ridge reservation. It is really the world's first "Atomic Ranch."

Six months after their accidental exposure to the bomb's radiation, the cattle began to react favorably to their new environment. A few calves were born which so far have turned out to be quite normal. However, they are only one generation removed from their radiation-afflicted parents. It may take as many as three or four bovine generations to ascertain damage to genes from atomic radiation.

Another important fact is that the loss of large patches of the "original" reddish hair were replaced with a "whitish" growth, which accounted for the cattle being referred to as "The Ghost Herd of Alamogordo." As a result, many visitors to Oak Ridge after the war actually expected to see cattle which were 100 per cent ghostly white. But they were due for a disappointment, for there was just a trace of a grayish-white streak down their backs and in patches near the rump on others.

The oversight that left these cattle in the bomb's wake was a "happy one" for science, the cattle industry, and the future of the human race. So much for the history. The "how" and "why" makes one of the most unique tales of the atomic age.

Almost three years passed following the Alamogordo bomb run, during which time the "atomic herd" continued to graze on the Oak Ridge ranch. The bell on the neck of old Adam, the atomic bull, tinkled occasionally. More calves were born and the herd increased. But people didn't give the matter much thought, if any, for there were more important matters. The eyes of the world were on Potsdam, Hiroshima, Nagasaki, Moscow, Operation Vittles and Operation Crossroads.

Then, in April, 1948, Dr. Albert H. Holland, Jr., director of the Atomic Energy Commission's Office of Research and Medicine at Oak Ridge, decided that the day had arrived for the "atomic cattle" to go "on stage." The arena of scientific research was to be made ready. A meeting was arranged for technical personnel of the AEC and the University of Tennessee in near-by Knoxville, which resulted in the AEC giving the University an initial grant of $250,000 and a contract for a long-range research project to be known as the UT-AEC project.

The University's president, Dr. C. E. Brehm, himself an agriculturalist of world-wide note, engaged Dr. C. L. Comar from the University of Florida, whose background was just about tailor-made for this project for he had been doing similar work at the University of Florida's Agricultural Experiment Station at Gainesville. He had actually fed minute

amounts of radioactive cobalt, copper, manganese, and other such elements to a motley collection of cattle, sheep, goats and swine. From these experiments he learned the actual distribution of these important elements within their systems.

More and more knowledge is being gained about cobalt. This has application to human beings, also, for just recently cobalt poisoning of some workers in the steel industry became an important problem requiring definite knowledge as to the distribution of cobalt in the body. However, the scope of the Florida project was definitely limited by the relatively small amounts of radioactive elements men were able to produce. Prior to the production of uranium-235 there was no machine in the world capable of producing radioactive elements on any scale.

The machine that could and *did* do the job was the atomic pile or furnace at Oak Ridge, called "furnace" because the uranium "bricks" actually produce intense radiations and heat. Ordinary elements placed within this "furnace" are "cooked" by the uranium rays which make them "hot" or radioactive elements. These elements, such as cobalt, carbon, aluminum, nickel, copper, manganese, etc., then emanate rays of their own, which, when injected in dead or living substances, can be traced every inch of the way by sensitive "ray detectors" known as Geiger Counters.

Thus, the entire cattle project shaped up as a scientific "natural" with the Alamogordo cattle transplanted to a range on a spot near the very "atomic furnace" or uranium pile that had produced the material for the bomb. Further this "natural" utilized the services of a scientist who had already applied the pre-war atom to animal husbandry, and all coordinated by a university with one of the best agricultural colleges in the southeast.

Nerve-center of the project, located barely a half-hour's drive from the gigantic atomic plants themselves, was an attractive, redbrick grammar school that was taken over and completely remodeled. The building now contains highly specialized laboratories to carry out experiments on animals ranging in size from mice to cattle.

These laboratories include a biological lab for use in studies in sperm physiology as well as other biological investigations. All manner of radioactive elements are being traced through various types of animal systems. . . . Then there is a Geiger Counter room where the intensities of atomic radiations can be measured. There is also a tissue dissection room, as well as a special room for the posting or slaughtering of large animals. In addition, a basement room, which was previ-

ously a cafeteria, is being set up as a small animal colony.

Additional construction will include an addition to the school building to provide for a complete chemical laboratory, a darkroom, a biochemical laboratory and an instrument room. A large nutrition barn is under way which will be quite large and will include two rooms especially equipped for the handling of high-level intensities of radioactivity.

As history the story of the atomic cattle is interesting. But what of their future? What does it portend for science and for man? First, the entire project started out with the sole purpose in mind of studying only the animals actually "exposed" to the original atomic radiation at Alamogordo. Later, however, the idea of the program changed completely. It was to be handled on a much broader scale. In addition to the original herd, Polled Herefords from South Carolina were purchased. These will be fed the radioactive tracer elements. Recent indications are that the atom-bombed cattle will not receive any such injections, but will be allowed to live out their normal lives, with the exception of a few which were slaughtered just recently for special autopsies.

One experiment recently completed involved the giving of radioactive phosphorus or P-32 to a normal steer calf from among the Polled Herefords. However, it will be a while before this information can be made public due to the fact that professional ethics require such findings to be published first in accepted scientific journals. And to complicate the matter still further there are the stringent security regulations of the Atomic Energy Commission.

According to Dr. Comar, the P-32 experiment may be "run" on as many as thirty or forty of the Polled Herefords during the next two years. The purpose of these experiments is to ascertain exactly what happens to various nutritionally important elements once inside the animal's digestive system.

Other interesting projects just getting under way include: (1) Several of the "bombed" steers are being slaughtered. Autopsies and tissue studies are being conducted. Samples of tissue are carefully measured with Geiger Counters to see if any of the radioactivity induced by the 1945 blast still remains. Should there be any radioactivity an attempt will be made to evaluate the possible health hazard that would result from human consumption of the meat from such animals. Such information would be extremely valuable in determining how the public could be safely fed in the event of large-scale atomic hostilities.

(2) Another project under way seeks to determine the behavior of calcium in cattle through the use

of radioactive calcium obtained from the Oak Ridge pile. Rats are the initial subjects for this experiment. The Polled Herefords will be used later. It is possible, for example, to follow radioactive calcium atoms from the pregnant female to the fetus and determine exactly how this exchange takes place.

Such an experiment will be of incalculable value to the cattle raiser for investigators will reveal where the calcium goes and the relative value of calcium sources tested. Dairymen and nutritionists will profit greatly from this data in learning new facts on feeding.

The manner in which the radioactive calcium is fed to the cattle subjects is interesting. An animal is injected with a dose of the radio calcium in a solution. After a certain period of time sufficient to allow the substance to penetrate throughout the animal's skeletal structure, the animal is slaughtered. Its bones are then processed into a "meal" containing a high content of radio-calcium. This is then fed to other animals and by so doing it is possible to "trace" the "meal" through their systems with the aid of highly sensitive Geiger Counters.

(3) A third project concerns the effect of atomic radiation on bull semen, as there is evidence and proof in many cases, that extremely high radiation levels cause sterility. This is even true in humans to a high degree. These studies will be made on (a) "bulls" exposed to the New Mexico bombing, and (b) young and mature males from among the Polled Herefords which have been artificially exposed to varying levels and types of concentrated irradiation.

For these experiments radioactive phosphorus plaques (P-32) are being utilized as an external source of atomic irradiation. Actually, the entire male organ of the bull can be irradiated by using the highly penetrating gamma rays from radioactive tantalum and cobalt. (Tantalum is a useful element in the manufacture of electric light filaments.) Semen for these studies is collected by means of an artificial vagina. The semen is measured for volume, concentration, motility and resistance to cold shock.

Selected females will be irradiated at different levels of intensity, thus permitting scientists to observe its effects on gestation, oestrus cycle, and reproductive performance. During these experiments complete weight, reproductive and blood records are maintained on all animals used. Periodic tissue studies are made with special attention being given the occurrence of late or "after" affects.

Much will be learned for a possible "breeding program" as a result of many of these experiments

applying radiation to reproductive organs. The danger of mutations will also be studied. "Mutations" are freak species; calves born with five legs, no eyes or lack of eye sockets, fused ribs, etc. Equally disastrous would be the onset of complete sterility as a result of atomic exposure. To date, nothing like this has happened with the "bombed" cattle, many of which are already grandparents.

However, it may take still another generation or two before any damage to genes would show its effects. And with the shadow of an atomic attack, the obtaining of facts such as these, gives pause to think again before possibly tampering with the future development of the entire human race by entering into large-scale atomic warfare.

So much for the immediate or short-range program. Let us now look ahead to 1960 and 1965 and see what kind of "long range" plans these investigators have.

The "exposed" cattle are included in the long-range program, aside from the steers, some of which have already been slaughtered. The remainder of the atomic herd will be observed over their entire life's span. Breeding records will be continued with emphasis on the search for the appearance of any abnormalities.

Another long-range project seeks the answer to the riddle of what happens to "trace" elements once inside an animal's system. A "trace" element is not to be confused with a "tracer." But oddly enough a "trace" element can be traced with a tracer. First it is necessary to explain that the substances necessary for animal health can be classified according to their main functions. The major dietary essentials such as fats, carbohydrates and proteins are required in *large* amounts and serve to supply energy for body activities and structural materials for growth and upkeep of tissues.

Now "trace" means an entirely *small* amount of an element. Calcium and phosphorus are *not* considered "trace" elements as they are required in large amounts primarily for structural purposes. However, no matter how small the amount of the "trace" element, it may be absolutely necessary to the animal's system. Such "trace" elements are traced through the use of identical radioactive tracers made in the nearby Oak Ridge atomic furnace.

There are two good reasons why observations on farm animals have been and are very important in bringing to light trace element imbalances. First, livestock are often restricted to forage within a relatively small area which increases the chance of the development of disease symptoms should the area happen to be deficient in any one or more of the necessary "trace"

elements. The other point, according to Dr. Comar, is that ruminants, as a result of their peculiar digestive processes, have been observed to require a higher level of certain trace elements than do other species.

Among the trace elements are cobalt, manganese, copper. There are many others, but these three will serve as immediate examples. Dr. Comar, incidentally, has already done much work along these lines at the University of Florida.

Tests At McCredie Farm

Condensed from Missouri Ruralist

THE United States Soil Conservation Service not only works in the field thru soils districts and field technicians, it also operates several experiment stations. One station is located in Missouri, near McCredie, on land typical of much of Missouri's prairie soils. It is called the Midwest Claypan Soil Conservation Experiment Farm.

On a recent field day held at the farm interest was high and nearly 500 persons attended.

Here is a brief review of tests reported and observed:

Pasture Tests—All pastures now are being fertilized to "sufficiency" by means of soil tests. This means about 800 pounds of 0–20–10 are being applied every 4 years. One good grazing combination has been brome and sweet clover. The two go together well in that cattle do less spot grazing. The combination returned 267 pounds of beef to the acre.

Timothy, lespedeza and sweet clover returned a little more beef to the acre—about 300 pounds.

In one test, soybeans have been harvested for grain, rye for pasture. Return from this combination was 34 bushels of beans and 208 pounds of beef to the acre. This plot gave highest soil loss of pasture plots, probably because 2 seedbeds were prepared in a year. This year Lincoln beans, an earlier variety, are being used in an attempt to get more fall pasture from rye. Thru the years, wheat has been a better crop than rye in this combination.

The old standby combination of wheat and lespedeza has averaged 160 pounds of beef on wheat, 209 pounds on lespedeza. This plot was last plowed in 1945. Normally, the seedbed is disked for wheat.

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Topeka, Kansas, July 8, 1950

When wheat was harvested for grain it made 30 bushels to the acre, and beef from lespedeza was the same, 209 pounds an acre. This meant a return of $4 an acre more when wheat was harvested for grain rather than grazed out.

It also was figured that when lespedeza was grazed for pasture it returned $2½ an acre more than when it was cut for hay.

A combination of alta fescue and bird's-foot trefoil also was observed, although no records are available yet. The bird's-foot trefoil stand has killed out but the fescue looks good.

Erosion Studies—An elaborate study is being made of the effect of cropping systems on erosion. The erosion plots are small and on a graduated 3 per cent slope. Adequate treatments of fertilizer are now used on these plots.

It has been observed that greatest aid in cutting down erosion is the "conditioning" of the soil thru use of grass and legumes. Erosion runs up to as much as 8 and 9 tons of soil an acre a year with a corn-oats rotation, but by adding grass and legumes to this rotation, loss can be reduced to 2 tons.

Here's another example. When soybeans are planted after corn the loss is 8 tons. But when soybeans are planted after grass the loss is 4 tons an acre.

Another important point in control of erosion is to have a cover on the ground when big rains of the year come. At least 24 inches of rain fall during the growing season.

But use of meadow alone will not cut down erosion. Erosion on corn after 4 years of meadow was more than after 1 year of meadow. The answer to this was that the long meadow rotation did not get as much fertilizer. There was not much grass left in the meadow at the end of 4 years.

Does application of commercial fertilizer cut erosion? It probably does by adding to root growth, and to the vigor of plants.

Subsoil Shattering—One thing studied at the McCredie farm has been shattering of claypan. These tests indicate the value of getting fertilizer down deep, perhaps up to 12 inches. But not much is gained by deeper shattering. Plenty of fertilizer, up to 1,000 pounds of 10–10–10, in the topsoil with lime has boosted yields up to more than 100 bushels of corn an acre.

Reclamation—A thin, badly-eroded section of the farm has been reclaimed with a rye-sweet clover rotation. Cost of mechanical reclamation, plowing in of gullies and terracing, has been $21.47 an acre. Fertilizer also has been added, as well as lime.

Cost of reclamation has been a good investment. The mechanical cost was $21 an acre, lime and manure cost about $31 an acre

more, and fertilizer and annual care cost $48 an acre more.

However, annual return has been $32 an acre and the field is getting better all the time.

Pasture Fertilization—Fertilization of bluegrass pasture has returned earlier and later pasture. On one bluegrass field 100 pounds of beef to the acre was made from November 16 to December 24 of last year.

One field has really received the "works." Three tons of lime and a half ton of rock phosphate on the surface, then plowed under 11 inches; then 3 more tons of lime and 1 ton of rock phosphate in the furrow. Then 3 more tons of lime and 1,000 pounds of rock phosphate were applied to the surface. This was seeded to alfalfa and brome grass.

Was this a good investment? It's too early to see. It has been grazed for only one short period this year, and in 9 days it returned 111 pounds of beef to the acre.

What Makes Cattle Prices?

Condensed from The Dakota Farmer

NOTHING is more interesting to beef cattle growers than how live cattle market prices get to be what they are. How does a packer determine what he will bid for killers on a certain day?

At a recent meeting of cattlemen, Mr. F. A. Simpson, head of the agricultural research department of Swift & Company, explained his company's method:

"Swift & Company, late every afternoon, receives reports of prices at which the various grades and weights of beef (not live animals) have been selling for that day. This information comes from all its sales outlets. Any reports which have not been received by late in the afternoon will come in during the night and will be tabulated, and the head beef man in Chicago will have this information by grades and weights early the next morning.

"From this, instructions will be sent out to plants at such places as Omaha, Kansas City, Denver, etc., asking them to try to buy cattle in line with what the beef is selling for. These instructions will only go to about 10 or 12 plants, and will apply only to cattle which are surplus for the consuming territory surrounding these plants, and to the plants which will expect Chicago to give them instruc-

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tions where and when to ship their surplus beef. Instructions apply only to surplus beef.

"At the plants themselves, such as Omaha, the beef man collects information from his plant's consuming territory regarding the prices at which beef, by grades and weights, is selling, and from this he issues the instructions to his cattle buyers. The point that I wish to make is that, in the end, the price that producers receive for their cattle is governed by what the packer can get for the meat and the by-products.

"The meat of course contributes, by far, the larger proportion. On the average, when the packer sells the products of a steer and other cattle, by-products represent approximately 15% of the total return from cattle. In hogs by-products only represent, on the average, about 3½% of the total income to the packer, and in sheep about 25% comes from the by-products. In other words, the by-products furnish enough to pay all the packer's expenses in handling and marketing cattle, and in addition the by-products help pay for the live animal.

"You have probably often wondered why livestock prices fluctuate from day to day and week to week. It is my opinion that the greatest single factor in influencing the ups and downs of livestock prices, is the variation in the number of cattle marketed. In the week of September 10, 1949, there were slaughtered under federal inspection approximately 250,000 cattle. The next week, September 17, there were slaughtered approximately 310,000, an increase of 60,000 over the week of September 10. This meant that the meat packers would have to sell 25% more beef the weeks ending October 1 and 8, than they would the weeks ending September 17 and 24. The only way the meat packers could sell this additional 25% more beef was by reducing the price.

"Retailers, through government reports, are fully aware of such increases in the supply of cattle, and they bid lower, because they know they are going to have to sell the beef at a lower price. Retailers in the large consuming areas vary, from week to week, the price at which they will sell their beef. It is, however, the variation in the prices which the packers receive for beef which causes the variation in the prices of cattle. As the money which consumers have to pay for meat does not vary much from week to week or month to month, the fluctuations in cattle prices are therefore traceable to the variation in the numbers of cattle marketed from week to week.

"In general, practically all beef is sold in 10 or 12 days after the cattle are slaughtered. Contrary to the general opinion, there is prac-

tically no frozen beef that is sold over the butcher's block. If we take all the beef that is frozen in a year and figure out what percentage that is of the total beef slaughtered, we will learn that it is, on the average, only 1.9%. This beef that is frozen is not the kind that goes over the butcher's block, but the kind which goes into meat loaves, sausages, and other prepared meats.

"The meat packer does not buy cattle when they are low in price, slaughter them and freeze the meat, and then bring the meat out when the price is high. If we were to take a carcass of beef today and split it in two, and freeze one side today, and tomorrow or two days from now offer for sale the frozen and the unfrozen side, we would find the frozen side would sell for approximately four cents a pound less than the unfrozen. The meat that goes over the butcher's block is hardly ever frozen, and we cannot use freezing methods to carry over surpluses of that kind of meat from day to day and week to week."

Year-Round Milk Cows

For a long time, scientists and some farmers have wondered if a cow could be milked all her life without going dry. Three Michigan State scientists have found you can make cows start lactation at an earlier age and keep them continuously in high production without periodic calvings. More than that, sterile heifers can be turned into heavy milkers.

As a result of their work with hormones, these scientists cautiously predict that "it should be possible to keep a normal animal in production indefinitely." So far, only a start has been made in this direction, but the future looks bright.

Last December a small incision was made on the right side of the neck of each of two sterile heifers. Two hormone tablets, diethyl stilbestrol and progesterone, were placed in the neck. One hundred days later the remainder of the tablets were removed. And the heifers, two and four years old, started producing milk—some 25 pounds a day apiece. What happened in effect was "pregnancy without conception."

—The Progressive Farmer

Preserving Organic Matter

Condensed from The Ohio Farmer

D. F. Beard and John Slipher

HAVE you ever seen a straw pile burning? Have you ever seen straw burning in the field? If you are over 50 years of age you have seen plenty of both! If you are under 30, chances are you have seen few straw piles burned but you have seen plenty of straw burned in the field. If you are between 30 and 50 years of age you have no doubt seen the amount of straw burned in the field increase as the amount burned in piles or stacks decreased.

This has come about during the past two decades because of the combine harvester. Grain farmers have always had a "surplus" straw problem. Now, even livestock farmers are faced with a straw problem, on a larger scale. Instead of being stacked in one location that "surplus" straw may be scattered over a large acreage.

But straw shouldn't be burned. It's an accepted fact that straw residue both conserves and adds organic matter to the soil. Straw on the surface brings soil into better tilth by a crumbing action. With that comes porosity—openness to receive rain-water and freer intake of fresh air and expulsion of spent air. Plowing is made easier and tillage operations are reduced on soils well stocked with organic matter. Straw residues contain the equivalent of 100 pounds or more of a good grade of fertilizer to the acre.

While plant residues remain on the surface as a mulch they reduce the temperature extremes in summer or winter. A mulched surface is ideal protection against soil erosion which not only carries away the soil itself but applied nutrients as well. This is true since most lime and fertilizer applications remain in the top few inches of soil.

Most farmers would like to leave the straw not needed for livestock bedding on the land where it was grown. But there are many drawbacks. Clover seedings are seriously injured and stands reduced when a heavy crop of wheat straw thrown out by the combine remains on the stubble. This results in lowered hay yields the following year.

Even a moderate crop of straw becomes objectionable when stubble and straw rakes up with the first hay crop. The problem is not solved by burning, for this destroys both the new seeding and valuable organic matter. The object desired is to be able to take

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Cleveland, Ohio, July 1, 1950

advantage of the fertilizing value of the straw without endangering the meadow seeding and future hay crops.

Farmers in some areas of Ohio mow or pasture the stubble field after grain harvest. Thus most of the straw will be tramped or worked down to the soil surface. This works almost as well as outright removal of the straw. However, the field may have patches where the straw wasn't tramped or worked down to the soil.

A good way to handle straw is to use an auxiliary cutter head on the combine itself. This mechanism, which can be attached to any make of combine, has worked well on many farms. The cutter head shreds and cuts the straw as it comes out of the combine. The action of the cutter reel spreads the small pieces of straw uniformly over a wide swath.

Most straw pieces are small enough to sift through upright stubble and undergrowth permitting early and intimate contact with the soil. This contact sets the decay process in action. Digestion by soil contact releases nutrients from the straw—mainly nitrogen and potash—to join those of the soil. Straw residues are largely decomposed by haymaking time. Thus the quality of the first hay crop is not reduced by large quantities of half-rotted straw picked up by the rake.

There's the further advantage of saving labor and machinery operations in handling the straw problem. In general, use of the auxiliary cutter head on combines is the best solution to the problem of making maximum use of the straw residue while at the same time preventing serious injury to the new meadow seeding. The cutter head can be left off the combine for that part of the straw which will be needed for livestock bedding.

Next to the grain straw problem is that of proper handling of soybean residues. This is another place where the auxiliary cutter head fills a long-standing need. The soybean has been accused, sometimes falsely, of being a prime cause of soil erosion. Fields that are not seeded after harvest with a winter cover crop are sometimes badly washed and gullied before the next crop occupies the land.

A strong winter grain cover crop is desirable following soybean harvest, but delayed harvesting often makes it difficult to prepare the soil in time for grain seeding. Also, soybean straw often stands in the way. Once the combined soybean haulm is dumped on the ground it starts to take up moisture and toughens.

Unless a sharp disk follows the combine, much of the soybean haulm is impossible to cut or work into the soil properly. Sometimes two or even three diskings still

leave the soil in poor condition for grain seeding. There will be bumps of tangled straw and soil forming islands over the entire field.

The auxiliary cutter head on the combine solves this problem by shredding and distributing the straw evenly over the soil surface. This eliminates time-consuming delays and extra working of the soil in working the haulm down for grain seeding. When precut haulm is spread evenly over the soil surface, wheat seeding becomes easy. The finely-cut haulm is an effective mulch and erosion-reducing measure as well as protector of soil tilth at a critical season. In fact, covering the soil uniformly with the finely-cut soybean residue may be practically as good as a grain cover crop.

Self Feeding Is More Efficient

Condensed from Hog Breeder

Robert H. Grummer
University of Wisconsin

I'LL wager that there are more discarded self-feeders filling farm ditches and cluttering up farm yards than any other piece of farm equipment. On a good many of these farms where we find these discarded feeders we find the hog men hand-feeding. This little piece of evidence probably is at least a partial answer to the limited amount of self-feeding that is being done.

On the basis of feeding trials, however, there appears to be no question but what self-feeding is more efficient than hand-feeding. An average from a large number of trials conducted by college experiment stations shows that both growing and fattening pigs gain more rapidly and use feed more efficiently when being self-fed than when being hand-fed. To be sure, some of our swine producers have never used a self-feeder—their fathers have practiced hand-feeding with good success and therefore they have never tried the self-feeder. On the other hand, there are just as many who have at some time or other used a self-feeder, but have now gone back to hand-feeding. We know that there are good hogs raised on hand-feeding as well as self-feeding, and if the hand-feeding is done properly, the results should be somewhat similar. However, we still have the big advantage of saving labor through the self-feeding method.

Perhaps the main reason that self-feeding is not more popular

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Chicago, Illinois, June 1950

than it is, is because we find too many self-feeders on the market that are mechanically unsound.

I doubt if the perfect self-feeder has been built—or whether one can be made to satisfy all requirements, but there are some good self-feeders on the market that come very near filling the bill. When a hog man goes to buy or build a self-feeder he should have some of the important characteristics in mind. First of all, a self-feeder should be durable. A piece of equipment has to last a relatively long time in order to be popular, and many of our commercial types of self-feeder do not stand up under the abuse of hogs and weather. Wooden self-feeders are vulnerable to rats and mice which soon chew holes in the feeder, thereby allowing the feed to leak out. To have lasting ability, a self-feeder should be made of metal, or if wood is desired, the lower part of the trough should be metal-lined. The covers to the feed trough are usually a weak point. These covers take a terrific beating from being lifted hundreds of times a day, and therefore should be attached very firmly.

Feed trough covers are very important, especially in an outside feeder, in order to keep out rain and snow, and to prevent the wind from blowing fine particles of feed out of the trough. For the same reasons, a cover should also be placed over the main feeder opening. A thoroughly covered feeder also has the advantage of keeping out rats, mice, and birds.

One big disadvantage of self-feeders has been that many of them waste feed, but this fault can usually be eliminated. Feeding troughs should be partitioned at 1-foot intervals so that each animal has a separate compartment from which to feed. When the entire trough is left unobstructed the hog will go down the trough sideways with his snout and rake out considerable amounts of feed. The compartment system will prevent this almost completely.

The depth of the feeder trough is also important. If it isn't at least 4 or 5 inches deep there is likely to be feed running over the top. To further prevent waste of feed the self-feeder should be adjustable. Some kind of a slide should be in the main part of the feeder to regulate the opening into the feed trough so that the feed doesn't flow too freely, and likewise, when using coarse bulky feeds, the opening should be widened to prevent the feed from bridging, thus causing a "dry" feeder. To accommodate all kinds of rations the feeder adjustment should allow for an opening that varies in width from one-half to 6 inches. For example, some of our whole grains such as shelled corn or wheat would require a relatively small opening—while rations con-

taining large amounts of ground legume hay and oats would need a wide opening. Even with a very flexible adjustment the self-feeder should be checked daily. Just because we are self-feeding doesn't mean that we can neglect the feeder and the hogs. A bridged feeder or empty feeder is a very costly one, and furthermore, a good hog man should look over his swine herd at least once a day.

It is a good idea to locate self-feeders on a platform. Although this might add extra expense and increase the rat hazard, a platform will lengthen the life of the feeder, and also hogs are more likely to pick up spilled feed from a platform than they are from the ground.

Every self-feeder should be supplied with a division in the main feed compartment. Then, if a farmer wants to feed free-choice style he will have one compartment for protein supplement and one compartment for grain. A hog is a very efficient animal at balancing its own ration. They normally will consume about 1 pound of protein supplement to 5 or 6 pounds of grain, thus the grain compartment should be 5 or 6 times the size of the supplement compartment.

The capacity or size of the feeder is another item to take into consideration. One of the big advantages of the self-feeder is to save labor. The feeder or feeders should hold enough feed to last at least a week. About 1 foot of self-feeder trough space will accommodate approximately 4 animals. For example, let us take a double-sided feeder 6 feet in length. This feeder will then provide for 48 animals. When they are reaching market weights they will consume 8 or more pounds of feed per day. Therefore, this self-feeder should hold about a ton and one-half to 2 tons of feed to last this group of hogs from a week to 10 days when they are approaching their maximum consumption.

On the other hand, it is unwise to provide more feeder space than is needed. When this is done oftentimes the feed will become rancid and moldy because the feed isn't being moved out of the feeders fast enough. To further prevent spoilage the corners of the self-feeder should be blocked out. It is in these corners where the pig cannot reach that old feed accumulates, becomes musty and eventually increases in amount because the pigs will avoid that part of the feeder.

There are certain classes of hogs that should be hand-fed. For example, it is desirable to hand-feed suckling sows, and in some cases show animals. with a self-feeder—a method that has proved to be practical and economical.

A little more caution in selecting or buying the right kind of a feeder should go a long way in increasing our pork profits.

Machine-baiting To Control Mice

Condensed from Farm Research

W. Robert Eadie
Cornell University

FRUIT growers face the threat of mouse damage to their orchards every year. Many practices can be followed in a sod orchard to minimize the danger from mice, but an annual baiting program is always necessary to reduce the mouse population to a safe level. Present systems of placing mouse baits by hand directly in mouse runways are effective, but also laborious, slow, and expensive in the large orchard. A method has recently been developed by which mouse bait can be distributed rapidly with common mechanical seeders. This has resulted in good control and substantial savings in labor costs.

To develop this method, studies were made on the foraging habits of field mice to determine whether they could readily find marked bait placements distributed widely at random in the grass and not in runways. This was done by placing grain baits at each of a large number of marked placement sites 5 feet apart in the grass. Runways were avoided. By various clues at the placement sites it was possible to determine with reasonable accuracy whether mice had found and accepted the baits. The result of almost a thousand such placements over a three-year period was that field mice found and accepted 41 per cent of the placements *overnight*. It was concluded that field mice apparently forage widely from their regular runways and that they should easily and quickly find grain baits distributed mechanically at 10 to 20 grains per foot of row in lines across the orchard.

Steps were next taken to develop an effective bait that could be distributed by mechanical seeders. Captured mice were tested under laboratory conditions, using a variety of treated grains. Coarsely cracked corn with 2 per cent zinc phosphide was finally chosen as an effective combination to use. A green dye was incorporated in the formula since it has been shown by other workers that abnormally colored grain has some repellent effect toward birds.

Field trials of the method were conducted in the fall of 1947 and again in 1948 in experimental orchards. The grain bait was distributed by means of a hand-operated garden seeder at a rate

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Geneva, New York, July 1950

of 10 to 20 grains per foot of row. Furrow openers and closers were first removed and a single line of prepared bait was distributed along the drip-line of the orchard tree rows. Mouse numbers were checked by trapping both before and after baiting. In 1947 there was a 75 per cent reduction in the number of mice caught after baiting; in 1948 the reduction was 85 per cent. Comparisons with the hand method of baiting showed that 75 per cent of the total costs could be saved by mechanical baiting.

In the fall of 1949 the method was used in commercial orchards for the first time, when more than 10,000 acres were treated. In large commercial orchards that were checked, trapping results showed a drastic reduction in the mouse population after mechanical baiting. In addition, 21 growers with 1,100 acres of orchard reported results after baiting mechanically in 1949. Of these, 17 reported good control; 3, fair control; and 1, poor control.

These results obtained to date compare favorably with results generally obtained from hand-distributed baits. The advantage of the new method lies in the savings in labor costs that result when one man can bait the orchard at a rate of 15 minutes or less per acre, using a hand-operated seeder. The method is also adaptable to machine-drawn seeders which is a big advantage in the large orchard and increases the speed and ease of the operation. This is important in years of high mouse numbers since a second bait application is easily possible if the situation warrants it. In commercial practice, bait is distributed on both sides of each tree row, at a rate of 3 or 4 pounds per acre.

Certain precautions must be observed with this method. The time of distribution is important since the bait should be dropped deep in the grass where the mice can find it most readily and where it is hidden from other wildlife. This is best accomplished before the grass mats down in late autumn and before leaf-fall. To protect wildlife, care must be taken not to distribute the bait on bare spots or across roadways or cart-tracks. Such bait in the open is not available to the mice, is wasted, and may introduce hazards. The shut-off devices on mechanical seeders can be used to stop the flow of grain over such areas.

A survey to determine the degree of hazard to wildlife in actual commercial use showed very little to exist. Inspection of more than 2,500 acres of treated orchard by the growers in 1949 showed a minimum of wildlife fatalities in the form of four cottontail rabbits. No wild birds of any type were known to have been killed by the bait. Special studies have shown that the hazard to pheasants is ap-

parently nonexistent or very low.

Studies on the use of this method of mouse control under variable conditions of ground cover and different mouse densities are being continued with the cooperation of the fruit growers of New York State.

Feed Best To 75 Pounds

Condensed from Successful Farming

Dean Wolf and Damon Catron
Iowa State College

INCREASING evidence has turned up during the past few years that we have been feeding "on the wrong end." Too many farmers feed their best rations to shove pigs weighing 75 pounds and more along to market. They've missed the critical times when feeding has the most to do with how many pigs are saved and how well they do.

All the feeding principles put together mean that, by doing an extra good job of feeding up to 75 pounds, you can move pigs along to market weight on less highly fortified rations which are less expensive. Feed the sow right at breeding time and during gestation and lactation. Feed the pigs right until they reach 75 pounds. Then, you can really start cutting feed-cost corners.

One Iowa farmer can tell you what happens when sows and pigs haven't been fed fortified rations during the pregnancy and suckling periods. Last spring he had a large number of sows, half to farrow in early April and the rest in June. The sows were fed a very simple ration of home-grown grains, soybean meal, and alfalfa meal. At farrowing time, pigs were weak and anemic. Many were squealers, with no pep to live.

By September 1, he sorted out an average of one runt per sow, ranging in weight from about 30 to 90 pounds. Some of the better early pigs weighed around 225.

To supplement corn-soybean meal rations, use 5 to 15 percent high-quality alfalfa meal; or 5 percent alfalfa meal plus 10 percent dried corn distillers' solubles; or 5 to 10 percent high-quality alfalfa meal plus 10 percent meat and bone scraps or tankage; or feed 5 percent alfalfa meal plus 2 to 3 percent condensed fish solubles.

As supplements to rations containing animal proteins, feed 10 to 12 percent good alfalfa meal; or 4 percent alfalfa meal plus 6 per-

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Des Moines, Iowa, April 1950

cent corn distillers' solubles; or 5 percent alfalfa meal plus 1 to 2 percent condensed fish solubles; or 5 percent alfalfa meal plus 1 to 2 percent condensed fish solubles plus 1 of dried fermentation solubles.

If the ration you fed your sows during gestation doesn't meet the above, it's all the more important that you fortify the ration during the suckling period. If your gestation ration had that extra punch, don't let up now. Keep those pigs building up more "storehouses" so you can cut costs from 75 pounds to market, when pigs eat the most feed.

More and more evidence is at hand that rations well fortified with B-vitamins, trace minerals, and certain APF concentrates produced by microbial fermentation will help prevent scours.

Scouring pigs have poor appetites. Even if on pasture, they won't eat enough green feed to get enough B-vitamins. This calls for a special built-up ration or a trip by a veterinarian. He can inject B-vitamins into the pigs to give them an appetite.

Some farmers give extra vitamins through the mouth with an oilcan. It seems to do the job for Donald and Ed Lee of West Liberty, Iowa. They give a mixture of liver extract, B-vitamins, and Vitamins A and D oil, and believe that it's the only way to keep down scours. Last spring, they dosed the bad ones every day and other pigs that weren't scouring, every other day.

Experiments with weaned pigs at the Iowa station indicate the part B-vitamins, trace minerals, and APF may play in preventing scours. In 13 lots of pigs, those fed rations fortified with these nutrients did not scour, while considerable scouring occurred in all lots fed the regular ration. This difference showed up in pasture lots as well as in dry lot.

Max Bailey of Story County, Iowa, thinks that a specially fortified ration even will help pigs snap out of certain kinds of scours. Last fall, he had about 175 pigs, and 25 to 50 percent of them developed scours. He got busy and called on the swine specialists at Iowa State College for help. They fixed a special ration for his pigs. He had his local feed manufacturer make it up. This special ration was highly fortified with B-vitamins, trace minerals, and APF. The pigs quit scouring and began putting on good gains again. Scouring had practically stopped six days after he started feeding the special ration.

A special sow-and-pig supplement is needed during the suckling period. As the amount of feed eaten by nursing pigs is relatively small, this sow-and-pig supplement should be made with a "safety factor" to avoid any possible chance of a nutritional defi-

ciency. It's important that enough APF and B-complex vitamins, such as riboflavin, niacin, and pantothenic acid, are in the supplement.

When the supplement has enough natural B-complex vitamin carriers, such as alfalfa meal, fish solubles, and dried corn distillers' solubles, they tend to cut the protein content. These supplements, which may run as low as 30 percent protein, have been criticized by many. But remember that the protein content alone is not a good measuring stick of the value. Always consider the vitamin and mineral content of a ration as well. Many swine nutritionists believe that a 30-percent protein supplement will do a better job in the dry lot than a 40-percent.

Here's an example of an excellent 18- to 20-percent protein sow-and-pig ration to be self-fed with shelled corn: 750 pounds ground yellow corn, 500 pounds rolled or ground hulled oats, 200 pounds wheat flour middlings, 100 pounds meat and bone scraps, 200 pounds soybean oil meal, 100 pounds cottonseed meal, 50 pounds linseed oil meal, 50 pounds dehydrated alfalfa meal, 0.5 pound Vitamin D_2 carrying 4 million units per pound, 3 grams riboflavin, 20 grams niacin, 10 grams pantothenic acid, 4 to 10 pounds APF (a level of 0.2 to 0.5 percent), 30 pounds ground limestone, 20 pounds steamed bonemeal, 10 pounds iodized salt, 2 to 4 pounds trace minerals.

This formula may look complicated but, remember, so are your feeding problems these days. The ration may be self-fed to sows and pigs, or fed to pigs in a creep.

Get sows and pigs to pasture as soon as weather permits. Pasture feeding covers up many dry lot feeding sins, and can save 25 to 50 percent of the protein supplement and about 5 percent of the grain needed to produce pork.

But here's a word to the wise when figuring the value of pasture: Some folks get a bit careless when they say that their "hogs are on pasture." There are all kinds of pasture—from very poor, dried-up bluegrass to excellent, succulent alfalfa. It takes *good* pasture.

Many farmers have been turning to the use of concrete lots to overcome diseases, parasites, water hauling, and fencing problems. This definitely creates nutritional deficiencies—new experiences for many good hog feeders if they continue to feed the ration which did the job on pasture. And most of these deficiencies show up in dry lot feeding during the critical period up to 75 pounds.

Another "must" to get pigs off to a good start and to keep them hustling along to an early market is to start them eating early. Early gains are the cheapest gains. Pigs that grow the fastest right from

the start are the ones that make the most money.

Little pigs will begin eating grain when they are 10 days old. A small pen or creep which allows the pigs to enter but keeps out the sows is a practical way of getting this job done.

If some runts develop in your herd, the experience of the farmer we mentioned earlier may suggest a way to straighten them out. He started self-feeding the batch of runts corn and a manufactured supplement adequate—for normal pigs—in APF, B-vitamins, and trace minerals. In six weeks, the number of runts had been reduced to less than a third of the original number.

This supplement was not a special "souped-up" feed. It was the same one sold generally by this feed concern, and it straightened out two-thirds of the runts or the so-called marginal runts.

The remaining runts were moved onto concrete and fed a special pig booster in which the APF was tripled, and dried whey added to supply some whey factor. This pig booster also was more highly fortified with pantothenic acid, riboflavin, niacin, and choline.

These runts had made some recovery on the regular supplement But immediately after they got the special pig booster, the big change came. The owner saved all but 2.5 percent of a large batch of runts. He estimates that only a third of them would have lived had they not been switched to the better ration.

Another new theory in hog feeding is being proposed by nutritionists. It's this business of "disease level" on the farm and how it affects the rations you should feed. They contend that the strength of the ration you need to feed depends on to what degree your fields, lots, and buildings are contaminated with disease.

To give you an idea of what kind of a ration may fit the disease level on your farm, let's illustrate with a couple of examples —Farmer A and Farmer B.

Farmer A is raising pigs in lots and permanent pasture where pigs have ranged for the past 10 years. Each year, he has experienced more and more trouble from scours, necro, erysipelas, bullnose, and unidentified pig ailments coming under the general classification of so-called "baby pig diseases." He is a renter. The farm isn't fenced hog-tight. And Farmer A isn't in a position to apply the clean-ground system.

So Farmer A should feed a ration something like this: 300 pounds meat and bone scraps, 700 pounds soybean meal, 100 pounds cottonseed meal, 100 pounds linseed meal, 300 pounds wheat flour middlings, 100 pounds wheat bran, 100 pounds dried corn distillers' solubles, 200 pounds dehy-

drated alfalfa meal, 1 pound Vitamin D_2 carrying 4 million units per pound, 10 grams riboflavin, 30 grams pantothenic acid, 40 grams niacin, 10 to 30 pounds APF concentrate, 60 pounds ground limestone, 40 pounds steamed bonemeal, 40 pounds iodized salt, and 5 to 10 pounds trace minerals.

The riboflavin, pantothenic acid, and niacin should first be premixed by dissolving in a quart of water and then thoroughly mixed with 10 pounds of soybean oil meal. Follow the manufacturer's directions on the APF and trace minerals. If the distillers' solubles are not available, use alfalfa meal.

The above ration is for feeding through gestation, lactation, and up to 75 pounds either in dry lot or on pasture. Self-feed the mixture with corn.

In contrast, Farmer B follows the clean-ground system. Pigs are on good alfalfa pasture as soon as weather permits. He shifts his dry lots, seldom has disease.

Under this low disease level, Farmer B can do an excellent job on pasture with this less expensive ration self-fed with corn: 300 pounds meat and bone scraps, 1,250 pounds soybean meal, 100 pounds cottonseed meal, 100 pounds linseed meal, 100 pounds alfalfa meal, 10 to 30 pounds APF concentrate, 80 pounds ground limestone, 50 pounds steamed bonemeal, and 40 pounds iodized salt.

In the dry lot, Farmer B should modify the above mixture by adding a pound of Vitamin D_2 carrying 4 million units per pound and 5 to 10 pounds trace minerals, and by replacing 200 pounds of soybean meal with 200 pounds alfalfa meal.

The more highly fortified ration for Farmer A is stepped up mainly in its content of B-vitamins and trace minerals. Farmer B may be able to do a fairly good job even with a less complex ration, but this one will give him the best results.

If the farmer finds it impossible to get such rations mixed, he may prefer to purchase manufactured supplements of similar quality.

Of course, feeding won't do the whole job. Prevention of diseases and parasites through good sanitation is necessary.

The best recommendation that can be given a farmer is to seek intelligent advice from a good veterinarian on disease problems. Your state agricultural college will be glad to help you on feeding and management problems.

Are Roosts Necessary?

Condensed from Poultry Tribune

G. T. Klein
University of Massachusetts

FIFTEEN years ago Ben Davis, Massachusetts, took the roosts out and leaned them against the north side of his poultry house. They never have been returned to the laying pens.

Davis thought other poultrymen were foolish to use roosts. Poultrymen thought Davis was crazy to take on such careless methods.

At poultry meetings the two sides had friendly arguments over roosts. No one was willing to give the idea a trial though they had plenty of opinions.

But during this time things were happening. Broiler growers were discarding roosts. Capon raisers were getting fewer crooked breasts and blisters on deep litter than on roosts.

Dropping boards and pits were discarded by some poultrymen, but they retained the roosts. Droppings fell into the litter to be discarded at the end of the year. Poultry raisers in Utah have used this method for years. It was okayed in Massachusetts by a few users, where it worked well in special breeding pens for the pedigree breeder.

While this was happening, we suddenly had a war on our hands. Wire was expensive and hard to buy. Lumber was scarce and expensive. Pullets were being raised in confinement without roosts. Why do they need roosts just because they have grown up, several argued.

During the past five years, houses without roosts have had a good test under quite a variety of conditions. Reports are variable. Some say production is just as high, there are no particular problems, and the saving in building cost is worth making. Some have tried it only to put roosts back after a season.

Roostless laying pens are definitely a two-sided question. On the favorable side poultrymen list these advantages:

1. A saving in building cost and upkeep.
2. Easier to work in the pen.
3. Eliminates one of the rat harbors.

On the unfavorable side:

1. A tendency for birds to try to roost on the feeders and nests.
2. More dampness of litter in the areas where the birds roost.

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Mount Morris, Illinois

Most of the New England observations have been made with heavy breeds. They give far less trouble from roosting on feeders and equipment than Leghorns. Yet, there are Leghorn men who have tried the plan and like it.

When roosts are in the pens, some heavy breeds have to be driven on them in the evening. It's more trouble to teach some flocks to roost than it is to keep birds off the equipment. And so it goes.

The only really serious charge against roostless pens is the damp litter. This is only noticeable in the coldest of winter weather, and it is confined to the part of the pen where birds roost. Applications of lime in this area are a help, and stirring the litter offsets it. Boxes of lime at the entrances to the nests are good foot driers. Mineral nesting material, or some similar material for a nest litter, is another foot cleaner when pen litter is damp.

Knowing that there are these disadvantages, I like to see poultrymen first make a trial run on a small scale. This is particularly important where roosts must be taken out of the pen to make this trial.

I'm sure we have not exhausted all possibilities in making roostless pens work. It's inviting trouble to have feeders and waterers with hop boards along the sides. These can just as well sit on the ground. Screen door springs and pieces of wire over feeders are far better than wooden reels.

Entrances to the nests can be boards which can be closed at night. They probably wouldn't have to be closed many nights before the birds were out of the notion of roosting on the nest entrance. The top of the nest ought to be a slanting board which discourages roosting. The Massachusetts clean egg nest gives less roosting trouble than other styles because of the type of entrance.

An automatic feeder set-up gives very little space to invite roosting. Carrier track used in Leghorn pens can have wire over it to prevent perching. There should be no exposed carrying pieces which would invite roosting.

Elimination of the rat nesting place is not to be taken lightly. That was always one of the weak points of the droppings pit, which is seldom cleaned more often than three to four times a year. The so-called elevated pit is in the same class.

Culling at night with a flashlight is more difficult in a roostless house. The flashlight method can still be used, but there is more milling around when you enter a roostless pen with a light. A catching hook is a good culling aid, and a roll of wire or a piece of fish net can be used to corral the flock into a small area.

Control of mites and lice is not

a problem in roostless pens. A once-a-year painting or spraying of the pen floor, lower wall area, and nests with pure carbolineum will keep mites under control. Lice can be killed by laying a section of snow fence or a number of laths on an area of the house, painting with nicotine sulfate or benzene hexachloride, and driving the birds into the area for an hour or so.

Roostless houses are used both with and without lights. It is simpler to have all night lights for a time after housing. Perhaps if these are run until the longer days of spring, it gives a good working plan. But lights are not a "must" in roostless houses by any means.

Sometimes floor eggs blamed on roostless pens are due to other causes. More broodiness is also doubtful.

Like most other things poultrymen do, roostless pens will not get an okay from all who use them. They have enough advantages to make it worthwhile to try to minimize the weak points.

The Nutrition of Horses

Condensed from The Maryland Farmer

Logan T. Wilson, Ph.D.

WORK horses on farms and in cities have been replaced to a large extent by mechanical power but horses for racing and pleasure still have an important place in livestock production.

Our knowledge on horse nutrition has been summarized recently in a report of the National Research Council Committee on Animal nutrition, entitled "Recommended Nutrient Allowances for Horses." This can be obtained from the National Research Council, 2101 Constitution Ave. N.W., Washington 25, D. C., price 50¢.

Many of the practices followed in horse feeding have been developed by observation and trial and error, rather than scientific investigations. People usually live closer to their horses than to other farm livestock, and so probably have made better observations with regard to the kinds of feeds that give best results with horses. On the other hand, there is much less scientific information on the nutritional requirements of horses

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than for most other classes of livestock. However, a good knowledge of what is known along this line can help in feeding more efficiently and in solving nutritional problems that may arise.

Feeding standards are based primarily on energy and protein requirements. A lot of figures have been worked out on energy requirements. They depend mainly on size and amount of work or exercise. Energy requirements indicate the amounts and concentrations of the feeds that should be used. In practice judging the energy requirements is fairly simple. A horse or colt that is too thin is not getting enough energy value, and needs more feed or a higher proportion of concentrated or grain feeds. Good quality leafy hays provide more energy than coarse stemmy hay or straw. A horse that is getting too fat needs less feed, particularly concentrate feeds.

Protein requirements for mature horses, either idle or working are comparatively low, and can usually be supplied by grass hays such as timothy, and grains of 9 to 10% protein content. There is of course no disadvantage in feeding more protein than is required if it is economical to do so, as the extra protein will be used for energy. There is also evidence that horses will do a little better, on somewhat more protein than the calculated requirements, especially when there is difficulty in maintaining a good body weight.

Protein is needed by growing colts and by brood mares during the last quarter of pregnancy and lactation. Good green pasture is high in protein and can supply all of the protein needed by mares and colts if they get enough of it. When good pasture is not available the extra protein can be supplied by some alfalfa or clover hay or a grain mixture of 14 to 15% protein. It is of interest that mares of draft breeds have been reported to produce from 26 to 77 lbs. of milk per day, which is well up to the output for good dairy cows. The protein in mares milk is only about ½ that for cows, but there is a considerable output of protein in milk which means that more should be supplied in the feed during lactation.

The minerals required in largest amounts are calcium, phosphorus and salt. *Calcium* and *phosphorus* are important for proper bone formation. In this regard the National Research Council report states:

"The proper development of the skeletal structures is particularly important in the horse and mule. The strain and stress on the skeletal structures of animals required to develop maximum energy outputs, such as the race horse running at its greatest speed or the draft horse under heavy loads, makes the mineral nutrition

of the horse of paramount importance. The nutrient requirement of the thoroughbred trained and put on the race track at the early age of 2 years is probably higher than for horses that are more mature before being trained for work.

"Very little is known about the relationship of nutrition to the etiology of various exostoses commonly seen in the horse such as spavins, ringbones and other bone diseases. Following the outbreak of equine osteomalacia in central Illinois (Law, 1911) the incidence of spavins, ringbones and other bone diseases was believed to be increased. Kintner and Holt (1932) reported that the admission rates of horses to army veterinary hospitals were much higher when the animals were fed a ration low in calcium than when the ration was supplemented with calcium. The incidence of various types of exostoses was higher among the horses on a calcium-deficient ration than on rations adequate with respect to this element."

As with protein requirements those for calcium and phosphorus are highest for growing colts and pregnant and lactating mares than for other mature horses. For such mature horses a ration of timothy hay and grain will just barely meet calcium and phosphorus recommendations. The larger amount needed by brood mares and colts can be supplied by a combination of legume hay for more calcium and feeds such as bran and linseed meal which are high in phosphorus. As an added safety factor a mineral supplement can be fed—either separately or in the grain mixture. It should be remembered that the amounts of minerals in pasture and hay may vary considerably, depending on soil fertility, stage of maturity, weather conditions, etc., so one cannot always depend on the average mineral analysis figures given for such feeds.

Salt should preferably be supplied free choice at all times. This is particularly true when horses are working heavily during warm weather, as considerable salt is lost in sweat. Under such conditions a deficiency of salt can result in exhaustion and loss of appetite. Horses will usually consume more flake salt than that in block form. They may take more than their actual requirements but any extra amount should have no harmful effect as the excess is easily excreted.

Of the so-called minor minerals *iodine* has received the most attention. A deficinecy of iodine results in colts which are born dead or too weak to stand and nurse. It is very cheap insurance to see that pregnant mares get iodized salt, or a mineral or feed fortified with iodine.

Copper deficiency symptoms have been reported for colts in certain areas in Australia. There is

little if any evidence of other mineral deficiencies in horses.

Excesses of certain minerals can be toxic. High *selenium* which occurs in feed grown in some areas in our Great Plains causes the condition known as "alkali disease" or "blind staggers." Phosphates high in *fluorine* should not be fed as they have caused toxic effects in various farm animals.

"On the basis of present information it would appear that the nutrition and feeding of horses with respect to vitamins is less of a problem than it is with some other domestic animals. However, this impression may be due to the meager amount of information available on the nutritional requirements of the horse."

Vitamin A is no doubt the one that is most likely to be deficient or sub optimum in horse rations. In the common feeds it occurs as the provitamin carotene, which is converted by the animal into vitamin A. The recommended allowance is given as 5.0 milligrams of carotene per 100 lbs. of body weight per day. This is equivalent to about 8000 units of vitamin A. A ration that does not include either pasture, hay, or silage that are of good quality will usually be deficient in vitamin A. However, deficiency symptoms do not occur for some time if the animals have a good store of vitamin A. "The deficiency is characterized by night blindness, lacrymation, keratinization of the cornea, respiratory symptoms, abscesses of the sublingual gland, incoordination, reproductive difficulties, capricious appetite and progressive weakness. The hoofs of deficient animals may show a pathological exuberance similar to increased scaling of epidermis." Bone structure may also be affected.

Vitamin D is required for utilization of calcium and phosphorus and so is also involved in bone structure. It can be supplied by exposure to sunlight as well as in the feed. A supplement of vitamin D in the feed can be provided quite cheaply and is good insurance especially for brood mares and growing colts.

Most of the *B vitamins* are required in the diet of the horse. They are not provided by rumen synthesis as in the case of cattle. Fortunately the requirements are usually provided by the feeds commonly used. An increased intake of these vitamins may help horses that are run down and have poor appetites. There is also some evidence that an increased intake of riboflavin (vitamin B_2) reduces the incidence of periodic ophthalmia or "moon-blindness," although it fails to correct the condition once it has developed.

Vitamin E "is widely distributed in the feeds normally consumed by horses" and there is

little evidence that supplements of this vitamin are of any value in treating sterility or abortion in horses.

Vitamin C is produced by the horse by body synthesis, the same as by other farm animals, and so is not required in the ration.

Calf Feeding Nature's Way

How these dairymen found that small-holed nipples are best for hand-feeding calves

You've probably seen hand-fed calves standing around sucking each other's ears and tails—and sometimes the teats on small heifers. This spreads disease, and harms young heifers' udders so that they sometimes develop mastitis when they come fresh.

Some dairy scientists in Australia got to wondering about the problem one day: why it is that a calf's urge to suck isn't satisfied when he's fed by hand? When a calf sucks his mother, he usually lies down completely satisfied after his meal—even though he gets no more milk than when he's fed by hand.

The Australians decided that first of all they would time how long it took calves to drink from an open pail; from a pail with a nipple; and from a nurse cow. They found that it takes about two minutes with an open pail, up to three minutes with a nipple pail, and 15 minutes from a nurse cow.

This set the dairymen to thinking that maybe if a calf worked harder at getting his meal, his sucking urge would be completely satisfied.

They tried this out by using pail nipples with smaller and smaller holes. After several trials they were using nipples with a hole only 1/80th of an inch in size. The calves had to suck for 20 minutes to get their milk, but they had no desire to suck each other after that. Froth developed around their mouths just as it does when a calf sucks a cow.

The Australians went one step farther: they rounded up several pairs of identical twins, and fed one of the twins with a large-holed nipple; his mate was put on a small-holed nipple. Quite a few of the calves on the larger holes got scours—but they recovered when they were shifted back to the small holes.

That, the Australians decided, was the answer: calves will be less likely to have scours and suck one another when you feed them on nipples with very small holes.

Try it and see if it doesn't work this way for you.

He Manufactures Beef

Condensed from The Hereford Journal

Rex Conn

"TOP price was paid for choice steers consigned by a Cascade, Iowa, feeder." That statement crops up with amazing regularity in the Chicago market reports. And if it is on a Wednesday, the chances are good that the top-selling bullocks are choice Herefords from the feedlots of Ed Reiter, for he has a load or more of cattle on the Chicago market every Wednesday of the year.

Mr. Reiter is one of a group of feeders centered around the Dubuque County town in eastern Iowa, who make their cattle choice.

Over the years these men have built a reputation for themselves and for their cattle. Buyers in the Chicago yards prick up their ears when they hear that Cascade cattle are on the market. The names of Ed Reiter and his sons, and a half-score other master feeders in the community are a sort of sterling mark on the cattle they ship. Buyers know that they will be honest cattle.

Ed Reiter is the dean of the group—the first to produce long-fed, market-topping beef.

"I have been feeding ever since I started farming for myself in 1912," Mr. Reiter said recently. "When I started feeding cattle the year around they laughed at me. They told me I was crazy to feed in the summer-time."

Mr. Reiter considers himself a manufacturer of choice beef rather than a speculator in cattle. Over the years he has evolved a system of feeding and marketing that takes a good share of the speculative element out of his operations.

First of all, he feeds only choice steers—two-year-olds mostly, although some heavy yearlings may be purchased in the fall to clean up the stalk fields before going into the feedlots. Most of his feeders are bought for him by Vince Donohoe, Kansas City order buyer, in Kansas and Nebraska.

Second, he keeps his feedlots filled to capacity the year around. He finishes about 60 carloads a year on his 312-acre home place.

Third, he markets a load or so of cattle every week in the year. Wednesday is his day at Chicago. Incapacitated by illness the last couple of years, Mr. Reiter watches with keen eye while his sons top out the fattest lot for the

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weekly shipment by truck to Chicago.

His volume and frequent purchases and sales take a good bit of the risk out of his operations, Mr. Reiter pointed out. The ups and downs of prices for feeder steers and fat cattle sort of wash themselves out over the course of time, he explained.

The Reiters use the standard Cornbelt ration: cracked shelled corn, linseed oilmeal and clover hay. The silos have stood empty in recent years.

"We used to feed silage," Ed Reiter said, "but we like to feed the big steers fast, so we stick to corn, linseed oilmeal and hay."

Labor is kept at a minimum in feeding the cattle. The corn is run through a burr mill and elevated to overhead bins from which it is dropped into the feeding wagons. The wagons are fitted with power-driven elevators at the rear which transfer the corn to the bunks without shoveling.

Feeding some 1,200 big cattle a year on 312 acres means buying a lot of feed, both corn and hay. Right now about 1,800 bushels of corn a week are coming onto the farm. Trucker dealers buy the corn over eastern Iowa and deliver it to the Reiter farm.

The Wednesday I visited Mr. Reiter the market report said three loads brought the top price of $32.75.

"Was one of the loads yours?" I asked.

"Well, it might have been," he replied with characteristic caution. "One of them weighed 1,200 pounds, and that was about what my load weighed."

It turned out that one of the market-topping loads was the Reiter cattle, too. And when you hear the Chicago top on a Wednesday, the chances are pretty good that it might have been paid for a load of choice Herefords from the Reiter feedlots.

An effective way to cure a horse of the habit of cribbing is to fasten securely a three-inch iron pipe length-wise on top of the manger, where the cribbing usually is done. After gripping the iron pipe a few times with his teeth, the horse will give up the habit as not worth the wear and tear on his teeth.—I. W. D.

—American Agriculturist

Liquid Nitrogen On A Custom Basis

Condensed from Kansas Farmer

Ed Rupp

LIQUID nitrogen has come to Kansas farms. This anhydrous ammonia is being applied mostly on corn over quite an extensive area in the vicinity of Salina. And several test strips were applied in oats and wheat late this spring.

It takes special equipment to handle and apply anhydrous ammonia. This equipment is quite expensive. For that reason most applications quite probably will be on a custom basis. It would take a large operation to handle anhydrous ammonia economically for the individual farm.

Pioneering this new enterprise in Central Kansas is G. M. McClellan, Salina. The work is being done under the name Nitro Fertilizer, Inc. Anhydrous ammonia is delivered to his bulk plant at Salina in tank cars that hold between 9,000 and 10,000 gallons. It is stored in a large 30,000-gallon pressure tank.

From the storage tank Mr. McClellan transports the nitrogen fertilizer in a tank trailer which has a rated load of 999 gallons. Another pressure tank mounted on the back of a tractor holds 112 gallons. It is from this tractor tank that the ammonia is applied to the soil. In gas form, it is applied behind 8 narrow cultivator shovels dropped 4 to 6 inches below the surface.

Ammonia changes from liquid to gas at 28 degrees below zero, its boiling point. Held under pressure in the tanks, it is in liquid form. But when released into the air it is a gas. It is in this gas form it is applied in the soil.

Watching the equipment work, we wonderd about the possibility of wet soil clogging up the outlets behind the narrow shovels. Mr. McClellan explained there was some chance of the orifices becoming clogged up, but that it was easily detected. It works somewhat like the refrigerator in your kitchen. The rapid change of pressure causes cooling. Frost collects on some parts of the equipment when ammonia is being applied. On the connecting hose between tank and shovels, moisture accumulates on the outside because of the cooling ammonia. Should the orifice become clogged frost and moisture disappear quite rapidly.

To prevent clogging the operator turns the ammonia on first then drops the shovels into the soil while the tractor is moving. There

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is a small loss of ammonia which drifts with the wind in a white cloud, but it assures even distribution.

From the tractor tank, Mr. McClellan uses metering equipment designed by W. A. Grotcher, of Clarksburg, Miss. Mr. Grotcher has been applying anhydrous ammonia for several years on a custom basis near Clarksburg. The metering equipment he designed is both simple and reliable. It is supposed to be within 2 per cent of correct. But Mr. McClellan says it has proved even more accurate than that in tests he has made.

Applications made so far have been at the rate of 40 pounds of available nitrogen an acre. Anhydrous ammonia carries about 82 per cent available nitrogen, a little more than twice as much nitrogen for each pound of material as carried by ammonium nitrate. Each gallon of anhydrous ammonia weighs 5 pounds. Filling the tractor tank 90 per cent of full, about 10 acres can be fertilized at the rate of 40 pounds of available nitrogen an acre before refilling with more ammonia.

Mr. McClellan got into the game a little late this year to make good comparative tests on small grains. He did run 7 wheat tests and 1 test on a field of oats that had blown badly. These test strips were applied in April, too late to make a fair comparison. However, the small area of oats which was fertilized looked far better prior to harvest than the unfertilized area in the same blown section of the field. In fact, the fertilized area looked a little better than the unfertilized section which was not damaged by blowing.

Only one wheat test was made with anhydrous ammonia alongside an earlier test with ammonium nitrate. The ammonium nitrate test was clearly visible thruout the growing season, but could be seen from the road only near the top of a hill as the wheat began to ripen. The anhydrous ammonia test was applied later than the recommended time. but the complete strip was clearly defined only a couple of weeks before harvest. From examination in the anhydrous strip, it appeared each head carried 2 or 3 more kernels than unfertilized wheat next to it.

Experimental work done at Kansas State College shows that nitrogen from either anhydrous ammonia or ammonium nitrate are equal pound for pound in crop response.

Considerable work with anhydrous ammonia has been done at the Mississippi Agricultural Experiment Station. Dr. W. B. Andrews, director of the station, reports so long as nitrogen is in ammonium form it does not leach from the soil. It must first be changed to the nitrate form. He reports in fertile soil in spring, ammonia is changed to nitrate nitro-

gen in 4 to 6 weeks. This is the background for the contention that anhydrous ammonia has better staying qualities, will not leach as rapidly as nitrate nitrogen applications.

Doctor Andrews also reports young plants seem to prefer ammonium nitrogen, while older plants seem to prefer nitrate nitrogen. However, he points out that in Mississippi experiments anhydrous ammonia has been equal to ammonium nitrate for side dressing. On cotton in Mississippi 32 pounds of nitrogen from anhydrous ammonia increased yields 354 pounds of seed cotton an acre, while the same amount applied in the ammonium nitrate form increased yields 277 pounds.

On corn the increase was 16.2 bushels an acre for anhydrous ammonia and the increase in yield was 14.3 bushels for ammonium nitrate. The difference was believed to be due to slower leaching of anhydrous ammonia.

As yet cost of anhydrous ammonia to a Kansas farmer is slightly higher than ammonium nitrate, but the difference is small. At $75 a ton, nitrogen from ammonium nitrate costs a little more than 11 cents a pound. Mr. McClellan is charging farmers 10 cents a pound for nitrogen in the anhydrous form. Cost of application at present is figured at $2 an acre by Mr. McClellan. An application of 40 pounds of available nitrogen an acre cost $6.

With ammonium nitrate at $75 a ton, it would cost $4.47 an acre for the material to apply 40 pounds of available nitrogen. That would leave $1.53 an acre for application costs and labor for handling the sacked material.

Keep The Farm in The Family

Condensed from Agricultural Situation

R. L. Berry, Sidney Henderson, E. B. Hill

AGE 59 is rather late in life to start paying off the major share of a farm, particularly when you have operated it all of your life. But that is exactly the situation that faced a Michigan farmer whose family had not taken proper measures for transferring the farm from father to son.

It's the kind of a situation that you can find repeated, with many variations, all over the country.

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The Michigan farmer had worked on the home place all of his life without a definite agreement as to his future interest in the farm. At first, he and his father operated the farm on a partnership basis. After his father died, he rented it from his mother. She died at the age of 82 without having made a will and he found that he shared the farm with two other heirs who lived in the city. This left him with the choice of giving up the home farm or attempting to buy out the other heirs.

Situations of this sort can be prevented by making at the right time suitable arrangements for transferring the farm from father to son or to son-in-law. To find out the best methods of making such transfers, a study has been made by the Michigan Agricultural Experiment Station and the Bureau of Agricultural Economics. Two hundred seventy Michigan farmers provided the basic information.

It is natural to want to keep the farm in the family. But there are some important things to think about before making up your mind. First of all, it is essential that you work out a fair and effective transfer that the whole family agrees upon. It should do *all* of the following: Provide reasonable security for the parents and for the farm operating son and his family. Provide equitable treatment for the other heirs. Make it possible to maintain the home farm as a going concern.

One of the main considerations in an agreement is the farm itself. It needs to be large enough and productive enough to provide an economic size of business. If it isn't it might be better to sell the farm to someone outside the family. In some cases, of course, the farm can be increased in size; or the nature of the business can be changed to make it more productive. The decision on whether the farm is of suitable size or productivity should be left largely to the son who will operate it.

Another thing to think about is the fact that not all farm sons and daughters want to farm. Some of them that do may find better farming opportunities elsewhere. In such cases it probably would be better to sell the place to someone who really wants it. In order to keep the home farm a going concern and in the hands of someone who easily fits into the life of the community, some farmers have worked out transfer agreements with neighborhood boys.

A third problem you may face arises when the son or son-in-law reaches the age of acquiring a farm before his parents are ready to retire. In such cases, it may be difficult to make a transfer that won't work to the disadvantage of either the son or the parents. This problem is not as difficult, of

course, if the place is big enough to support two families.

These are samples of the difficulties that can arise when you think of keeping the farm in the family. Since they involve the welfare of the parents, children and the farm, it is essential that the whole family participate in the agreement. Failure to work out a fair and effective transfer can result in serious economic loss to all concerned. Furthermore, it can involve the family in disagreements and legal squabbles that can cause more heartaches than do dollar and cent losses.

In the Michigan study, several types of transfers were studied. The two types found most satisfactory for most family situations were transfer by sale or contract and transfer by will.

Sales agreements and contracts. —Transfers of this kind have much to recommend them, particularly when the parents are retiring. They are clean-cut business transactions in which all parties know exactly where they stand. The son knows he will have the farm if he keeps up the payments. The payments help provide for the needs of the parents during their old age and retirement. Other children will inherit their share of the parents' personal property including unused money received from the sale of the farm. Of course, it is possible that the parents may live long enough after selling the farm to a son so that the money from the sale will be used up and nothing will be left for any of the heirs.

Sales agreements and contracts also permit the son to own the farm at a much earlier age than other types of transfers. The study showed that sons average 42 to 45 years of age when they inherit. Most of them, however, are ready to start farming at 25 years or younger.

Once a son definitely has title to a farm, he can begin his own long-time farming program. He will feel more confident about making improvements than if he is not sure when or if he will own the farm.

There are two main types of sales agreements and contracts:

1. Outright sale with a cash down payment and a mortgage.

2. Land contracts in which the parents keep title to the farm and receive periodic cash payments. These contracts provide that title be transferred when a certain percentage of the principal has been paid. Some provide that the unpaid part of the contract be canceled after the death of the parents. They also may specify that a home on the farm be provided the parents, or that certain expenses of the parents such as doctor and hospital bills are to be paid by the son.

Other kinds of contracts may be used. One of them is the annuity

plan in which the son agrees to make annual or monthly payments based on the value of the farm and the number of years his parents are expected to live. If the parents live longer than expected the son may pay more than the value of the farm. If they live less than the expected time, the reverse will be the case.

The price at which a farm is to be sold or upon which contract payments are to be based should be carefully determined. When land values are unusually high a sale at the market value would be to the disadvantage of the son.

Transfer by will.—Farm families may not find it advisable to sell or otherwise transfer the farm to the son or son-in-law at a particular time. In such cases, a conditional will may be made. Such a will may provide that on the death of the parents, the son receiving the farm shall settle with the other heirs. The will may specify the amount of the settlement, or it may provide that the son pay a certain percentage of the appraised value at the time he inherits the farm. The latter plan would avoid difficulties due to changes in the value of the land or in the condition of the estate.

Such a will provides a satisfactory transfer arrangement in case the father dies before reaching the time of retirement. If the father lives, the will could be replaced later by outright sale or land contract.

Transferring the land by will is often not satisfactory to the farm-operating son. His future equity in the farm is not certain since he may not know the exact contents of the will and the will usually can be changed at any time by the maker. In addition, he may not receive the farm early enough in life.

In families where it is decided to transfer the land by will, it is good practice for parents and children to reach an understanding that the farm will be left to the son who will operate it.

Wills made by farmers often are improperly prepared. This often leads to legal difficulties that will delay transfers. If you plan to make a will, it is a good idea to talk with a lawyer.

In addition to the above methods of transferring the farm from father to son, the following methods often are used. In general, these are not recommended as good ways of making the transfer.

Life estates.—In this type of transfer, the son is given title to the farm with the reservation of a life estate or "life lease" for one or both parents. The main purpose of such a transfer usually is to give the farm to the son and at the same time provide an income for the widow. This is an awkward arrangement which frequently leads to dissatisfaction and to neglect of

the farm. It is not recommended as a good way of transferring the farm.

Joint deeds.—The father sometimes gives a son a joint deed to the farm. In case of the death of either, the farm goes to the survivor. Both parties have equal rights in the property. Neither may sell, rent, or mortgage it without the consent of the other. If father and son agree on everything, the joint deed may be satisfactory. But even the best of families sometimes disagree. Disputes are more likely when property is jointly owned.

Laws of descent and distribution.—When no arrangement to transfer the farm is made while the parents are living, the property is divided among the heirs according to State laws. If one son is to acquire ownership, he must arrange to buy the farm from the other heirs. This can lead to all sorts of difficulties. The laws of descent are seldom a good way of transferring the farm except when the farm operating son is the only heir.

Gifts.—Most young farmers are not looking for a gift of the home farm. What most of them want is the opportunity to start to become a farm owner at a relatively early age. They are willing to pay for the farm if given the opportunity to do so during their most productive years. Many outright gifts of farms by father to son have not turned out well. It should be noted that transferring the farm by life estate or joint deed are forms of gifts.

Verbal promises.—It is a good idea for a father and son to start the process of transferring the farm with a verbal understanding. But it makes a poor finish unless followed by a written agreement in legal form. To avoid regrets, it is a good plan to get your agreements down in black and white.

The Michigan study indicates that there is no one best way of transferring the farm from father to son. A method suitable for one family may not fit another. The best arrangement for your family depends on the following: (1) The ages of the parents; (2) whether the parents are ready to retire; (3) the size of the parents' estate; (4) the income needed by the parents or surviving parent; (5) the size of the farm; (6) the age and family status of the farm-operating son; (7) the number of other heirs.

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"When tillage begins, other arts follow. The farmers, therefore, are the founders of human civilization."

—*Daniel Webster*

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